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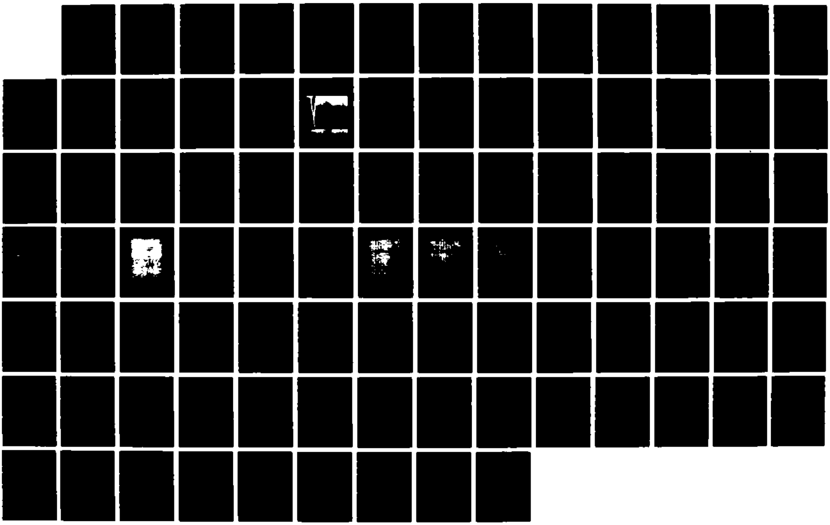

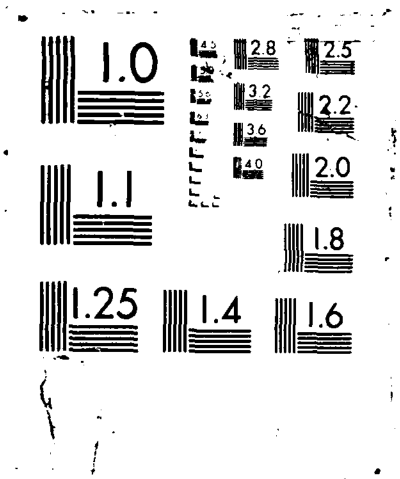
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MARINE PHYSICAL
LABORATORY

SCRIPPS INSTITUTION OF OCEANOGRAPHY

San Diego, California 92152

TRIP REPORT - AUGUST 1987 SWALLOW FLOAT DEPLOYMENT WITH RUM

G. L. D'Spain, W. S. Hodgkiss, and G. L. Edmonds

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ABSTRACT

A special engineering test involving the deployment of two of the Marine Physical Laboratory's Swallow floats and the Remote Underwater Manipulator (RUM) was conducted in August, 1987, in the Catalina Basin, 33.2° N, 118.5° W. Representative data collected by the two Swallow floats are presented. The 1-20 Hz Swallow float acoustic data are dominated by the presence of RUM.

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Introduction

A special engineering test involving the deployment of two of the Marine Physical Laboratory's Swallow floats and the Remote Underwater Manipulator (RUM) was conducted in August, 1987. The purpose of the Swallow float experiment was to try to determine the effect of flow noise on the geophone signal levels and to deploy a Swallow float geophone sensor on the sediment using RUM. The experimental site was located in the Catalina basin (33° 12′ N, 118° 30′ W) in 1240 meter deep water. A summary of the Swallow float data that were collected on 13-14 August are presented herein.

The Swallow floats, which have been under development for the last six years at the Marine Physical Laboratory, were designed to be neutrally buoyant, freely drifting, very low frequency (1-20 Hz) particle velocity sensors. They usually contain within a 0.432 m diameter glass shell a three-component geophone (to measure the VLF particle velocity), a magnetic compass, and the necessary hardware to record up to 25 hours of data. They also usually contain an 8 kHz acoustic localization system.

However, both of the Swallow floats, floats 0 and 11, were modified for this experiment. Instead of being freely drifting, float 0 was tethered to the ocean bottom in the configuration shown in Figure 1. This tether arrangement was designed to help maintain a fixed, but upright, position of the float in an ocean current. Float 11 was also deployed on the bottom as shown in Figure 1. Its three-component geophone was external to the float's glass sphere containing the system electronics. It was connected to the float recording hardware by a 2.4-meter-long cable, composed of seven #18 stranded wires within a neoprene insulation. Each of the stranded wires was connected to one of the glass sphere's seven penetrators; two wires/penetrators were required for each of the three geophone components and one for ground. (The 12 Swallow float glass spheres have a various number of penetrators; floats 1, 2, 4, and 11 have seven penetrators, floats 3, 5, 6, 7, 8, 9, and 10 have five penetrators, and float 0 has three penetrators. Float 11 was chosen for modification because it had seven penetrators). No penetrators were available for float 11's 8 kHz hydrophone; therefore, no localization data were collected by this float. The geophone unit, enclosed in a pressure casing, was mounted on a 1/4-inch by 10-inch (0.64 cm by 25.4 cm) polyvinylchloride (pvc) disk on which the horizontal orientation of the geophone's x and y axes was marked. This mounting guaranteed that the unit, which was placed on the sediment by RUM, would be upright. (The three orthogonal components of the geophone can only withstand up to a 15° tilt from vertical).

Two additional changes were made to each of the floats. The float flashers, attached to the plastic hardhats protecting the glass spheres, were configured so that they operated while at depth. Normally, a pressure-activated switch in the flashers opens when the floats descend in the water. Also, the fixed gain in the geophone electronic system was decreased by 6 dB from 95 dB to 89 dB. The power spectral levels reported in Section VI take this change in system gain

into account.

The Ocean Research Barge (ORB), a towed marine research platform operated by the Marine Physical Laboratory, was used to deploy RUM and the Swallow floats. RUM carried the two floats to the bottom, placed float 0's anchor on the sediment, and set float 11's anchor and geophone package on the sediment. It was also planned to use RUM to retrieve the two floats. However, the corrosion links between the floats and their anchors broke before RUM, delayed by a blown fuse in its boom water pump, could locate the floats on the ocean bottom.

An average sound speed profile, derived from historical National Oceanographic Data Center (NODC) temperature and salinity data and an empirical equation relating sound speed to temperature and salinity, is presented in Figure 2. The NODC data were collected in the area, 31-34° N, 116-120° W, which encompasses the Catalina Basin. For a water depth of 1240 m, the profile has a negative velocity gradient with depth for about the upper 2/3 of the water column.

Swallow Float Log Summary

Note: All times are in local Pacific Daylight Time. To obtain standard Greenwich Mean Time, add 7 hours.

13 August 1987

10:00	Synchronize floats. Float 11's cassette tape started running on power up. The tape is rewound.
11:09	Start launch of RUM.
11:30	RUM, with the two Swallow floats, is put in the water.
11:58	RUM starts to descend.
12:40	RUM is passing 700 ft. (213 m). Maximum rate of descent is about 40 ft/min (12.2 m/min); otherwise, the anchor of float 0 would be lifted off RUM.
14:07	RUM is 1500 ft. (457 m) from the bottom. Descent rate is 25 ft/min (7.6 m/min) because of rough seas.
15:20	RUM is on the ocean bottom.
16:03	RUM begins pickup of float 11's geophone unit in order to deploy it on the sediment.
16:30	RUM is finished deploying float 11 and float 0. RUM is now taking box cores of sediments.
23:45	RUM just finished collecting 7 box cores.

14 August 1987

05:37	RUM lifts off ocean bottom and is bringing back to ORB 6 good box cores.
06:30	RUM is ascending to the surface.
10:44	Start opening the doors on ORB with pressure oscillation of 0.5 to 1 Hz.
10:47	ORB doors are down.
10:49	RUM is in the water.
11:10	RUM is descending. During RUM's visit to the surface, the box cores were recovered.
12:08	RUM is presently at 1245 ft. (380 m) above the ocean floor.

15:03 RUM is on ocean bottom and is returning to the surface. It started to locate, and retrieve, the Swallow floats when its boom water pump quit.

15:10 Float 0 is ascending. It is at 500 m depth.

15:43 RUM is on the surface. A fuse is replaced and the vehicle will be redeployed to retrieve float 11 before its corrosion link breaks.

16:15 The "Fast Cat" shuttle is on station. Marvin Darling and Greg Edmonds depart for San Diego.

22:30 Fred Uhlman spots flashers on the ocean surface about 30 m off ORB. The two Swallow floats and one 10-inch flotation buoy are recovered. The corrosion links broke before RUM could locate the floats on the ocean bottom.

I. General Indication of Data Quality

The results of screening the float data tapes for the proper location of resynchronization characters and the proper sum of byte values in a group prior to a checksum are shown in Figure I.1, titled "August 1987 RUM Deployment Data Screening Results". These screening results are typical of recent Swallow float deployments. Both floats recorded full data tapes with only 0.5 % bad records.

The last table entry under each float shows a record with zero bytes. A zero byte record is always written at the end of the data tape indicating the total number of internal records recorded by that float. Note that float 11 recorded about a hundred fewer records than float 0. When the floats were initially powered up, float 11's cassette tape incorrectly spun forward. The tape was only partially rewound, leaving the beginning of the tape blank.

II. The 8 kHz Surface and Bottom Bounce Data

The next plot, Figure II.1, shows the arrival times, converted to depth, of the self-generated 8 kHz acoustic location ping for float 0. (Recall that float 11 was not equipped with an 8 kHz localization hydrophone). The sampling interval in this plot is 2 records, or 1.5 minutes.

The first 200 records or so were written while the float was still on board ORB. The line of arrivals sloping downward to the right starting about record 200 represent the reflections of the 8 kHz localization ping off the ocean-air interface as the float descends. (The possibility that the first arrival in this group represents scattering from a near-surface layer composed of bubbles and/or biological organisms remains to be investigated [1]). The line of arrivals sloping upward to the right indicate the ocean bottom reflection. Note the change in slope of these two sets of arrivals at about 350 m depth (between records 280 and 295). Since RUM, which was carrying the float, was being lowered in the water by a cable from ORB, this change in slope probably represents a change in the rate at which RUM was lowered. During the initial descent, the Swallow floats were observed on RUM's remote video camera to be lifting off RUM due to flow drag. RUM's descent rate was therefore slowed.

Three sets of arrivals are distinguishable once the float reached the bottom. The set starting at zero depth represent the recording of the ping itself, multiple reflections off the float sphere and the ocean bottom, and scattered arrivals. These scattered arrivals may include ringing by the glass sphere since theoretical calculations predict the sphere to be resonant at 8 kHz. The set of arrivals at 1232 m depth starting at about record 450 are the aforementioned surface reflections, followed by scattered arrivals. Just below these arrivals, seen clearly while the float is in descent between records 200 and 450, is the set of arrivals representing the phase which either reflects off the ocean surface and then the ocean bottom or off the bottom and then the surface before being recorded by the float. It can barely be distinguished in the scattered

arrivals of the surface bounce phase once the float reaches the bottom. The depth indicated by this phase, 1256 m, represents the true water depth measured by the localization system. (Note that this depth may differ from the actual water depth due to the use of an incorrect average sound velocity. The value used in creating these plots was 1500 m/sec. From Figure 2, however, this value appears to be too large. If an average velocity of 1485 m/sec is taken, the water depth estimate is 1243 m). The difference between this phase's depth measurement and the depth measured by the surface bounce phase, 24 m, is a measure of the distance between the hydrophone and the ocean bottom. This result is somewhat puzzling since float 0 had only 18 m of tether. Possible explanations are that the surface reflection arrivals are, in fact, preceeded by an arrival scattered from a near surface layer, or possibly that the 8 kHz ping penetrates the sediment layer a few meters before being returned.

The variation in the duration of the scattered arrivals after both the 0 depth arrival and the surface bounce phase appear to be similar. Since the detectability of an 8 kHz arrival depends upon the background noise levels, then those times with few scattered arrivals, e.g. between records 800 and 1200, probably represent times when the background noise levels around 8 kHz were high [1].

III. Float Heading and AGC Level

Figures III.1 and III.2 display the battery voltage, compass heading, and AGC gain for the two floats. The value of each of these quantities for every 45 sec record is plotted. As can be seen by the flat nature of the battery-output plots, the deployment time for the floats is certainly not constrained by power-supply requirements.

The compass heading for float 0 during RUM's descent (record 200 to record 450) shows large variations. During the descent, float 0's glass sphere containing the compass was allowed to pay out above RUM and the compass heading records the "fluttering" of the float. Once on the bottom, RUM set float 0's anchor on the sediment, around record 500. This action appears to have no effect on the compass. During the remainder of the recorded data, the float slowly made 1 1/2 turns counterclockwise as seen from above the float.

Float 11, however, was placed in a container on RUM while in descent. During this period, its compass appears to have been stuck; the compass can only withstand a 3° tilt from vertical. The compass heading jumped to a slightly larger value and stuck again while RUM was deploying the float on the sediment, between records 480 and 520. After an initial jump to values greater than 180° after the float was set on the sediment, the compass then appears to have stuck for the remainder of the data recording period. The sticking of float 11's compass was of no consequence since the float's geophone was external to the sphere.

The automatic gain control (AGC) settings for both of the floats, except for the decrease from an initialized value of 12 dB for the first 24 records (the AGC can only change in 1/2-dB increments between each record), remained at 0 dB gain. The only exception was in float 11's AGC level at the end of the recording period, starting around record 1775, or 08:10 on 14 August. This occurred about the time when RUM was being recovered with its 6 box cores (re "Swallow Float Log Summary"). During the last ten records or so of float 11's data, (corresponding to 09:10 to 09:18, 14 August) the AGC was increasing at its maximum rate. Float 0's geophone signals were probably contaminated by tether effects; it appears from the compass heading plot to have remained at the end of maximum extent of its tether for the full duration of the data recording period. However, both floats' geophone data were probably also significantly contaminated by the presence of RUM.

IV. Root Mean Square Velocity

Plots of the rms velocity for all the records of float 0 and float 11 are presented in Figures IV.1a through IV.1j and Figures IV.2a through IV.2j, respectively. Five seconds of data, or 250 points, are averaged together, yielding nine points per record. The rms velocity indicated by the first 24 records is misleading. Actually, the geophone signal is clipped all during this time as the AGC level, initially at 12 dB gain, steps down to 0 in half-dB increments. Therefore, the gain-corrected rms velocity for a clipped signal is smaller when the AGC gain is high than when it is low.

The rms velocity on the z axis for float 0 shows a striking decrease in level between records 275 and 300. This time corresponds to the change in the slope of the surface bounce arrivals at 350 m depth discussed in Section 2. No corresponding decrease in float 11's z component occurred at this time. After record 300 and until the bottom is reached, float 0's horizontal components show a low frequency oscillation of 7 1/2 minute period.

The arrival of RUM on the ocean bottom is evident in float 0's rms velocity data at about record 472 (15:54, 13 August) by an increase in all three channels' levels (Figure IV.1c). Float 11 horizontal data, whose geophone unit was resting at a tilt directly on RUM, show a decrease in level (Figure IV.2c). (A sharp decrease to 0 rms velocity on all three channels, e.g. the three occurrences around record 425 in float 11's data, are due to a bad or missing record, representing 9 missing rms velocity data points). Only float 11 records the deployment of the two floats by RUM; a slight increase in level on the y component, and to a lesser extent on the x component, occurs around record 480. The external geophone appears to have been placed on the sediment around record 518, when the variation in rms levels increases. For some unknown reason, float 11's z axis shows a few large decreases in signal level, until record 538 (16:43, 13 August). Thereafter, until record 1617 (06:13, 14 August, when RUM was departing from the bottom), the rms velocity recorded by float 11 was a maximum on all three channels. During this time, float 0 recorded a portion of data where the rms velocity levels were less than maximum, from record 846 (20:35, 13 August) until around record 1325 (02:30, 14 August). A couple of interesting changes in level occur in this interval, re Figure IV.1f. At record 1083 (23:32, 13 August) the z axis level decreases, at record 1106 (23:50, 13 August) it increases again, and another decrease in the level on the z component occurs at record 1134 (00:10, 14 August). These changes in level are probably associated with changes in RUM activity; a log entry indicates that RUM finished collecting box cores at 23:45.

Float 0 data show a small decrease in signal levels between records 1600 and 1625, corresponding to the decrease in float 11's levels due to the departure of RUM from the ocean floor. However, float 0's levels rise and remain at maximum until around record 1835 (08:55, 14 August). The change at this time could be caused by a decrease in tether contamination or possibly the recovery of RUM on ORB. Another sudden increase in float 0's levels occurs at record 1926 (10:05, 14 August).

Float 11, because the beginning portion of its cassette tape was not used, stopped recording data sooner than float 0; 09:18 vs 10:45, 14 August. It did record some interesting low frequency variations in signal level (Figures IV.2i,j), which are especially prominent after record 1775. These oscillations, with periods between 6 and 9 minutes, may be a manifestation of the propagation effects from RUM to the sediment-mounted geophone as RUM ascended to the ocean surface.

V. Velocity Time Series

Selected time series, sampled at 50 Hz, from all three orthogonal geophone components are plotted in Figures V.1 through V.4. Four record sequences are presented; records 1610 to 1621 (06:07 to 06:16, 14 August) for float 11, records 1845 to 1856 (09:04 to 09:13, 14 August) for both floats, and records 1964 to 1975 (10:33 to 10:42, 14 August) for float 0. These sequences were

chosen for further analysis since: a) between records 1610 and 1621 (Figures V.3), float 11's rms velocity suddenly decreased, presumably due to the departure of RUM from the bottom; b) the 12 record sequence starting at record 1845 (Figures V.1 and V.4) was written near the time when RUM was recovered on ORB, and both floats' rms velocity levels were less than maximum; c) records 1964 to 1975 (Figures V.2) are the last 12 records written by float 0, and may contain the signal generated by the opening of ORB's doors at 10:44, 14 August.

Clipping occurs on all of float 0's x, y, and z axes' time series during the record sequence 1845 to 1856 and for most of the horizontal components' time series between records 1964 to 1975. The vertical axis during the latter sequence (Figure V.2c), however, is not clipped. The impulsive arrival occurring 10 sec into the even numbered records is float 0's 8 kHz localization ping. Float 11's time series are also clipped for the first 8 to 10 records of the sequence 1610 to 1621 (Figures V.3). Once RUM leaves the bottom, clipping ceases and float 11's records are dominated by a continuous signal (Figures V.4). One notable impulsive arrival is clearly recorded 10 seconds into record 1847 (09:05, 14 August) on float 11's y and z axes. This cannot be float 0's 8 kHz localization ping since the ping occurred only in even numbered records. The origin of this signal is unknown.

VI. Velocity and Acoustic Pressure Power Spectra

Estimates of the calibrated power spectra for the geophone velocity components, as well as the derived pressure power spectra, are presented for the two record sequences, records 1845-1856 for both floats, and records 1964-1975 for float 0. The spectra were calculated for each record by incoherently averaging seven 512-point FFTs which were overlapped by 50%. A Kaiser-Bessel window with alpha equal 2.5 was used. This followed the procedure used in previous reports.

The power spectral estimates for float 0's geophone signals during records 1845 to 1856 are plotted in Figures VI.1 through VI.12. The large amount of clipping of the float's time series during this time (re Figures V.1a, b, c), makes interpretation of the spectra difficult. For example, clipping of a pure sinusoid can result in the generation of sub-harmonics and harmonics of the original signal, and the apparent power in each of these harmonics depends upon the degree of clipping. Also, for float 0, the clipping may be the result of tether effects rather than a water-borne, acoustic signal. The dominant spectral peaks at the beginning of this series of records (Figure VI.1) occur at 1.4 Hz, 2.5 Hz, 4.0 Hz, 7.4 Hz, and 8.2 Hz. The double spectral peaks at 7.4 Hz and 8.2 Hz, especially dominant on the z axis, merge into one peak at about 7.8 Hz between records 1849 and 1850 (Figures VI.5 and VI.6). Record 1850 was recorded at 09:07, 14 August.

The estimated power spectra obtained from float 11's geophone data during this same period (Figures VI.25 to VI.36) have a background level that is about 20 dB lower across the frequency band. Either float 0's tether generates an extra 20 dB of noise, or the water-sediment coupling of the sound from RUM, which is near the ocean surface at this time, is poor. The dominant spectral peaks at the beginning of the record sequence occur at 4.3 Hz, 6.8 Hz, 8.6 Hz, 9.3 Hz, and 15 Hz (re Figure VI.25). The peak at 4.3 Hz is especially large; it is almost 120 dB re 1 μPa. However, by record 1856, this peak has almost disappeared. A peak at 3.7 Hz appears and becomes dominant between records 1853 and 1854 (09:10, 14 August), with an estimated power level about 8 dB below the 4.3 Hz peak level. Another change over this period is the disappearance of the 6.8 Hz peak, which is replaced by peaks at 6.0 Hz and 7.3 Hz. These changes are probably associated with changes in the signal generated by RUM. Note the smooth appearance of the spectral estimates for record 1847 (Figure VI.27) in which the impulsive arrival discussed in the last section occurred. The spectral levels are elevated above 18 Hz and below 2 Hz on all components due to this arrival.

Another impulsive arrival which has an effect on the spectral amplitudes is the 8 kHz acoustic localization ping, clearly recorded on float 0's z component of the even numbered

records between 1964 and 1975 (Figure V.2c). The corresponding spectra for this set of records (Figures VI.25 through VI.36) show higher power levels for the even numbered records than the odd numbered records, especially between 4 Hz and 9 Hz. The dominant spectral peaks are at 0.4 Hz, 1.3 Hz, 1.8 Hz, 3.3 Hz, 3.6 Hz, 4.1 Hz, 5.5 Hz, 9.2 Hz, and 15 Hz. The very prominent 3.6 Hz peak on the z axis was seen in float 11's power spectra recorded between records 1845 and 1856. The peaks at 4.1 Hz and 9.2 Hz were also seen in the previously discussed spectra. These spectral lines are probably generated by RUM. Note that the background levels during this time are about 20 dB below the levels measured by float 0 between records 1845 and 1856, suggesting that tether contamination caused the clipping seen in the earlier records.

To investigate the spectral amplitude structure at the lowest frequencies recorded by float 0, the spectra for two records, record 1856 and record 1974, were replotted so that the highest power levels were not cut off. These plots are Figures VI.37 and VI.38, respectively. A spectral peak of about 157 dB re 1 μPa at 0.4 Hz appears clearly in record 1974. This spectral line may be caused by the oscillation of ORB's doors. There is a hint of the presence of a 0.4 Hz signal in record 1856's spectra. Due to the extensive signal clipping at this time, the background levels are higher for this record than for record 1974 and may mask the line. However, the power level of the line, if it is present, is at least 10 dB lower than in record 1974.

Acknowledgements

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References

[1] G. L. D'Spain, R. L. Culver, W. S. Hodgkiss, and G. L. Edmonds, "Trip report - April, 1987 Swallow float deployment" Marine Physical Laboratory, Scripps Institution of Oceanography, San Diego, CA (1987).

Appendix 1 - Geophone Data Acquisition System

A block diagram of the geophone system appears in Figure A1.1. (Note that the figures for this appendix appear immediately following the text). The water particle motion (or sediment particle motion for float 11's geophone) is first coupled into motion at the geophone. The particle velocity at the geophone is then converted into voltages representing the three orthogonal components of particle velocity. The geophones are electromagnetic transducers in which a voltage is produced across a moving, conducting coil by its motion through the magnetic field lines produced by a permanent magnet. The resulting voltage is proportional to the velocity of the coil with respect to the magnet. Constraining the coil to move in only one direction are elastic springs connecting the coil to the instrument casing. (Laboratory tests have determined that the geophones can withstand a maximum tilt from vertical of about 15°). Using the theoretical equation of motion for this system, the transducer frequency response was derived and is shown in Figure A1.2. (The amplitude response curve is identical to the manufacturer's calibration curve provided with the geophones). The near-critical damping of the coil is achieved using a 60 kΩ shunt resistor. Note that the f^2 roll-off of the geophone amplitude response below the natural frequency of 8 Hz aids in "pre-whitening" the ocean ambient noise, which appears to increase as f^{-4} below about 5 Hz. The geophone in each Swallow float is composed of three such transducers oriented to measure in three orthogonal directions.

The three signals next undergo a fixed gain of 89 dB and an additional gain determined by the AGC (re Section III) so that the full dynamic range of the A/D converter can be used. As mentioned previously, this fixed gain was reduced in both floats for this deployment from its usual value of 95 dB.

Before digitizing, the signals are passed through a five-pole, four-zero, elliptic, anti-aliasing filter. Elliptic filters theoretically have the sharpest transition region for a given number of poles and circuit complexity. The filter frequency response and the pole, zero locations in the s plane are shown in Figure A1.3. Incoming signals are amplified by a maximum of 4.6 dB in the passband, which has a 0.28 dB equal ripple. The cut-off frequency (the highest frequency at which the amplitude gain is equal to the passband gain) is 20 Hz, and the attenuation is 19.5 dB at the Nyquist frequency of 25 Hz. The maximum equal ripple level in the stop band is 50.1 dB below the level in the pass band and is first reached at 31 Hz. Before installation in the floats, all filters were adjusted so that broadband noise input to the filters yielded the same amplitude response and same null location at the filters' output.

The three signals are then digitized at a 50 Hz sampling rate and then put into a temporary buffer. After 44 seconds of data (equal to one data record) have accumulated in the buffer, a one second period of writing the data to cassette tape takes place. During this time, no data is accumulated. The 45 second cycle then repeats until the cassette tape is full. The cassette tape can store up to 17 Mbytes of unformatted data, which is sufficient space for up to 2000 data records.

Both the RMS velocity plots discussed in Section IV and the geophone time series plots of Section V have been corrected for the variable AGC level. No other adjustments have been made in these plots. The power spectral plots of Section VI, however, have been corrected for all electronic system gains (including the geophone and the anti-aliasing filter responses) and therefore report estimates of the actual signal power level at the input to the geophones.

In the Spring of 1988, the entire geophone data acquisition system will be calibrated in the Navy calibration facility in Hotham Sound in southeastern Canada.

BLOCK DIAGRAM OF THE GEOPHONE DATA ACQUISITION SYSTEM

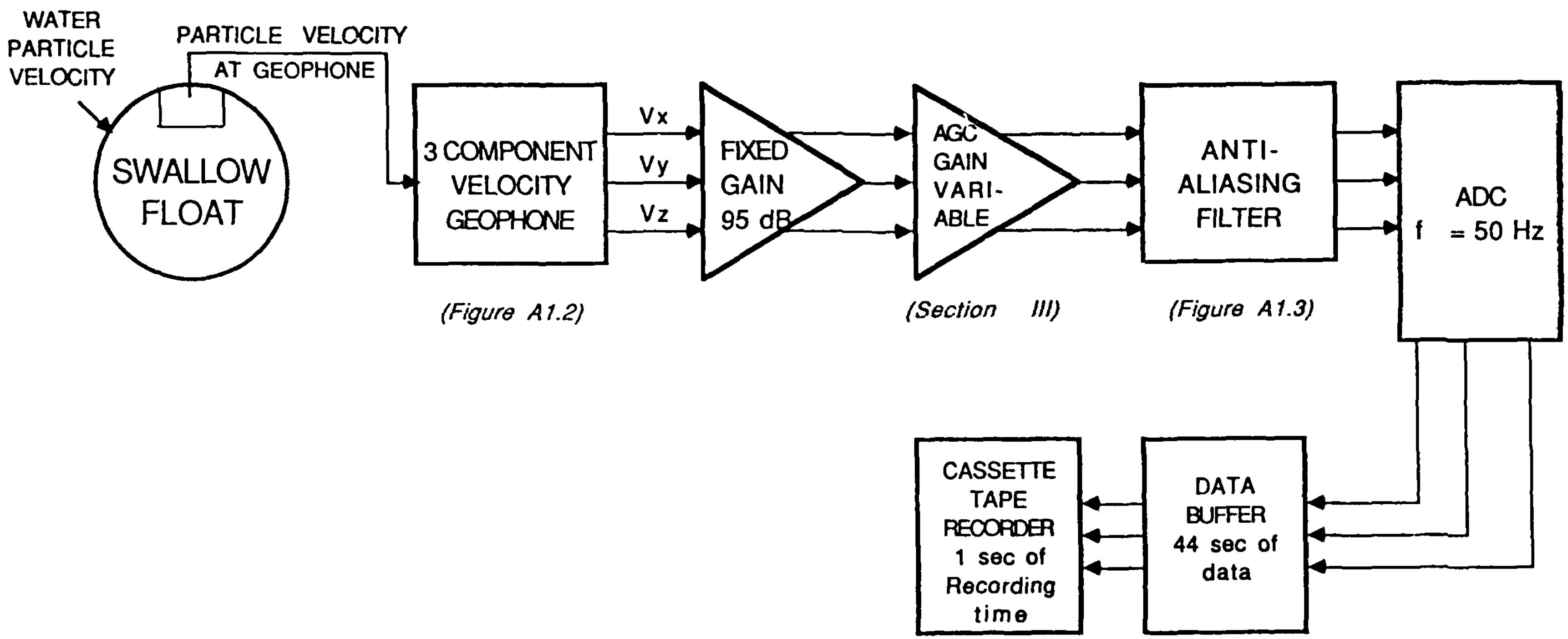
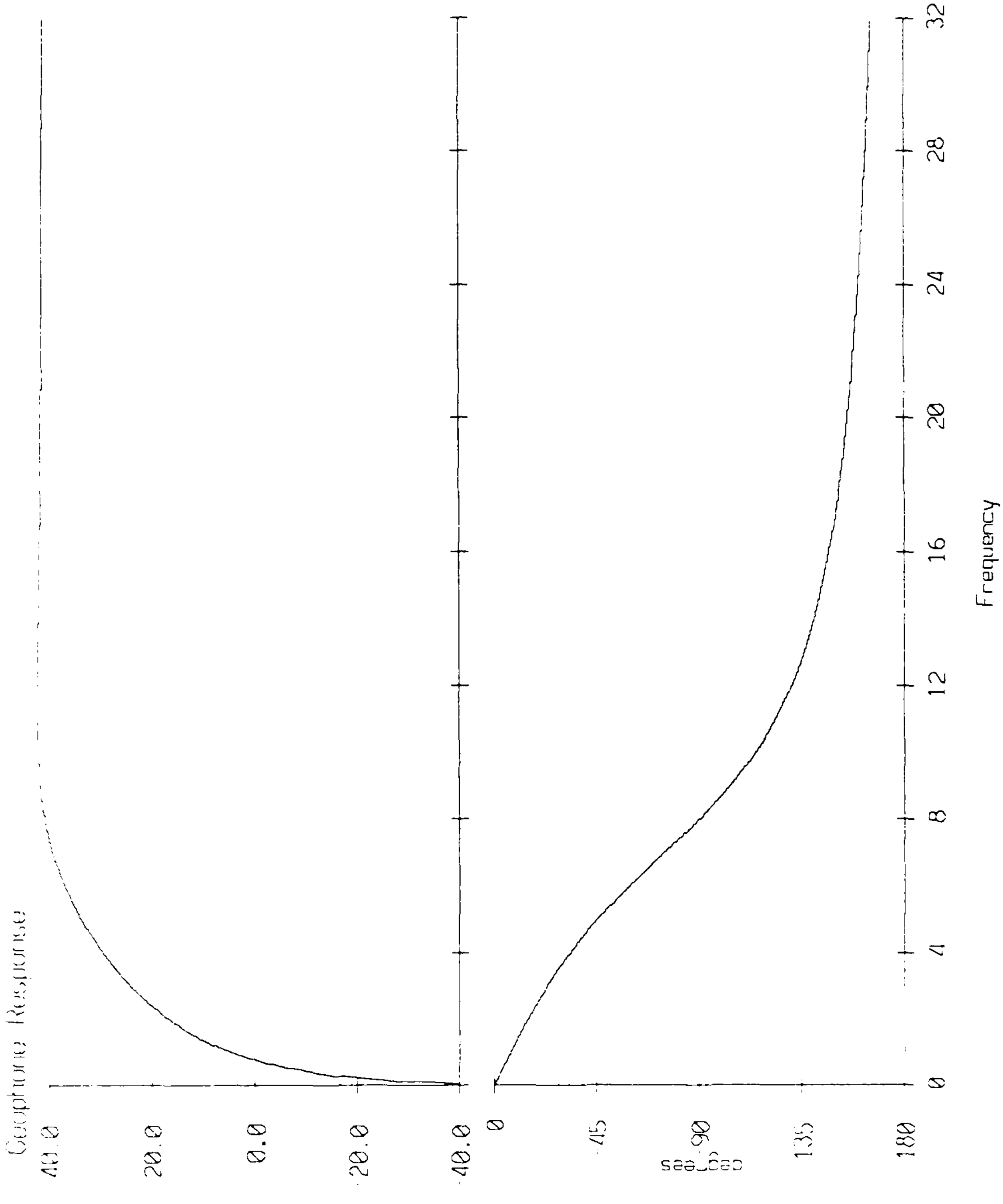


Figure A1.1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0.0
-20.0
-40.0
Magnitude (dB re 1 volt/m/sec)
0
45
90
135
180
Phase
degrees
0
4
8
12
16
20
24
28
32
Frequency

Figure A1.2

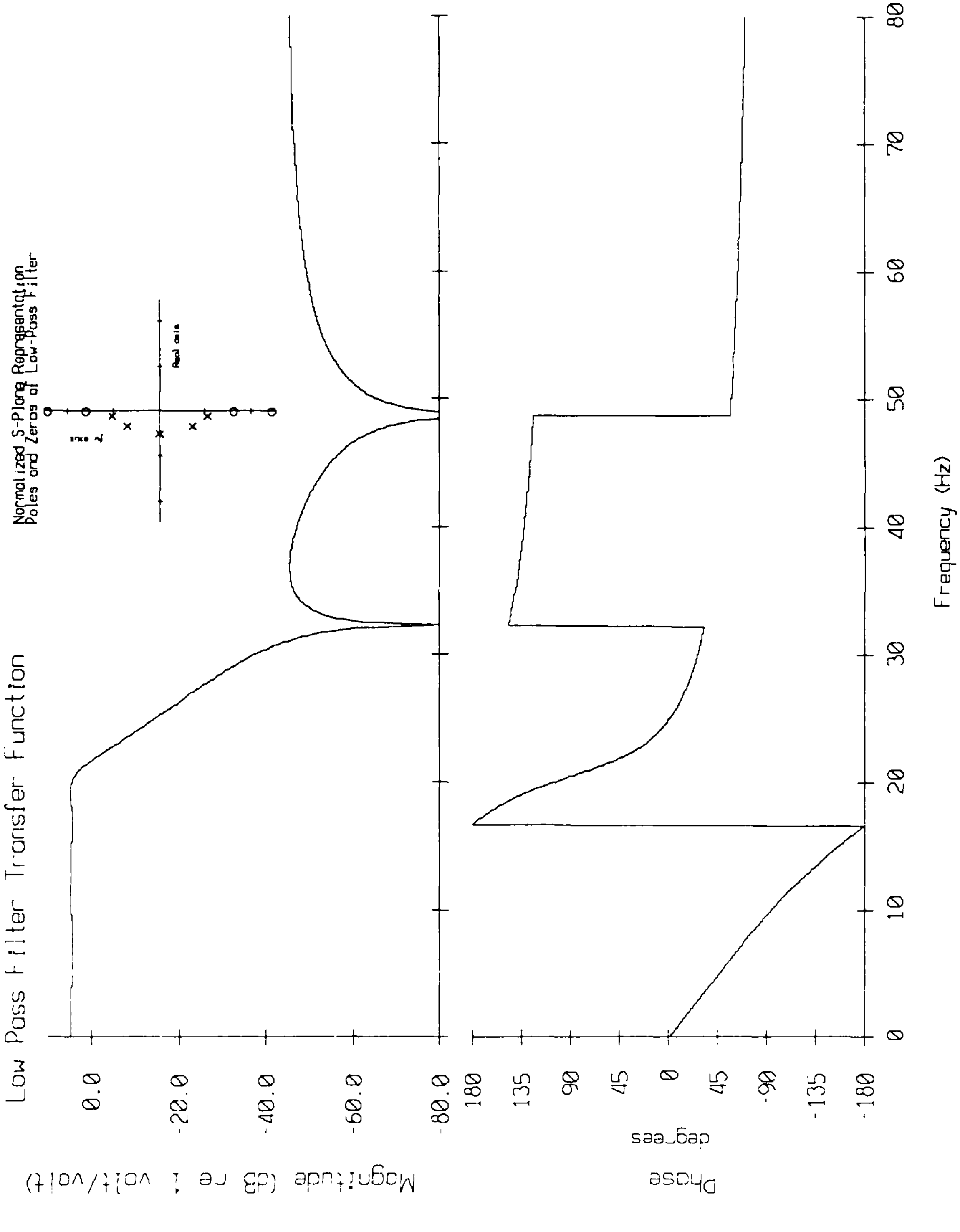

Low Pass Filter Transfer Function
Normalized S-Plane Representation
Poles and Zeros of Low-Pass Filter
Magnitude (dB re 1 volt/volt)
0.0
-20.0
-40.0
-60.0
-80.0
Phase
degrees
180
135
90
45
0
-45
-90
-135
-180
0
10
20
30
40
50
60
70
80
Frequency (Hz)

Figure A1.3

Deployment Configuration for the Two Swallow Floats

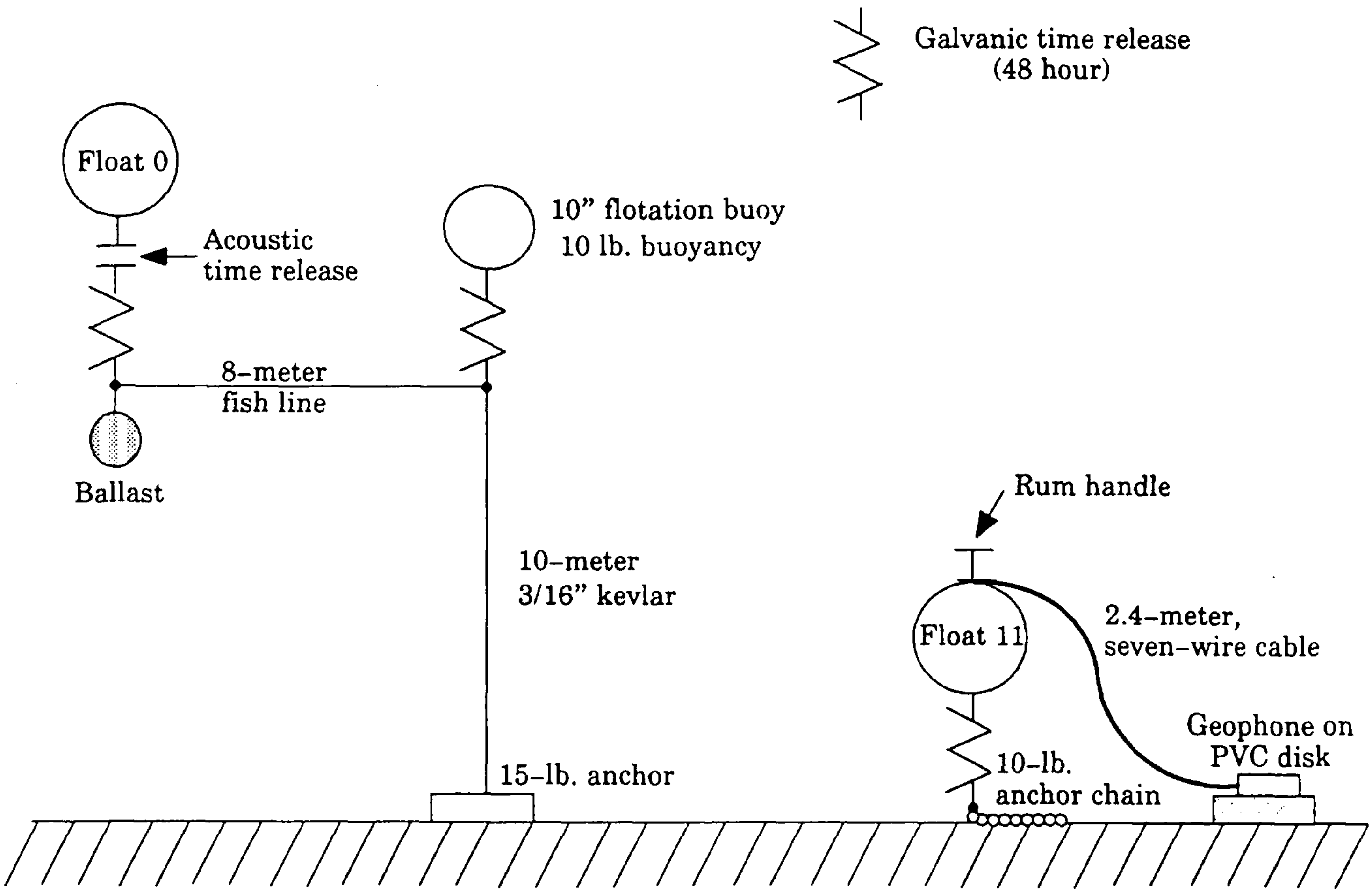


Figure 1

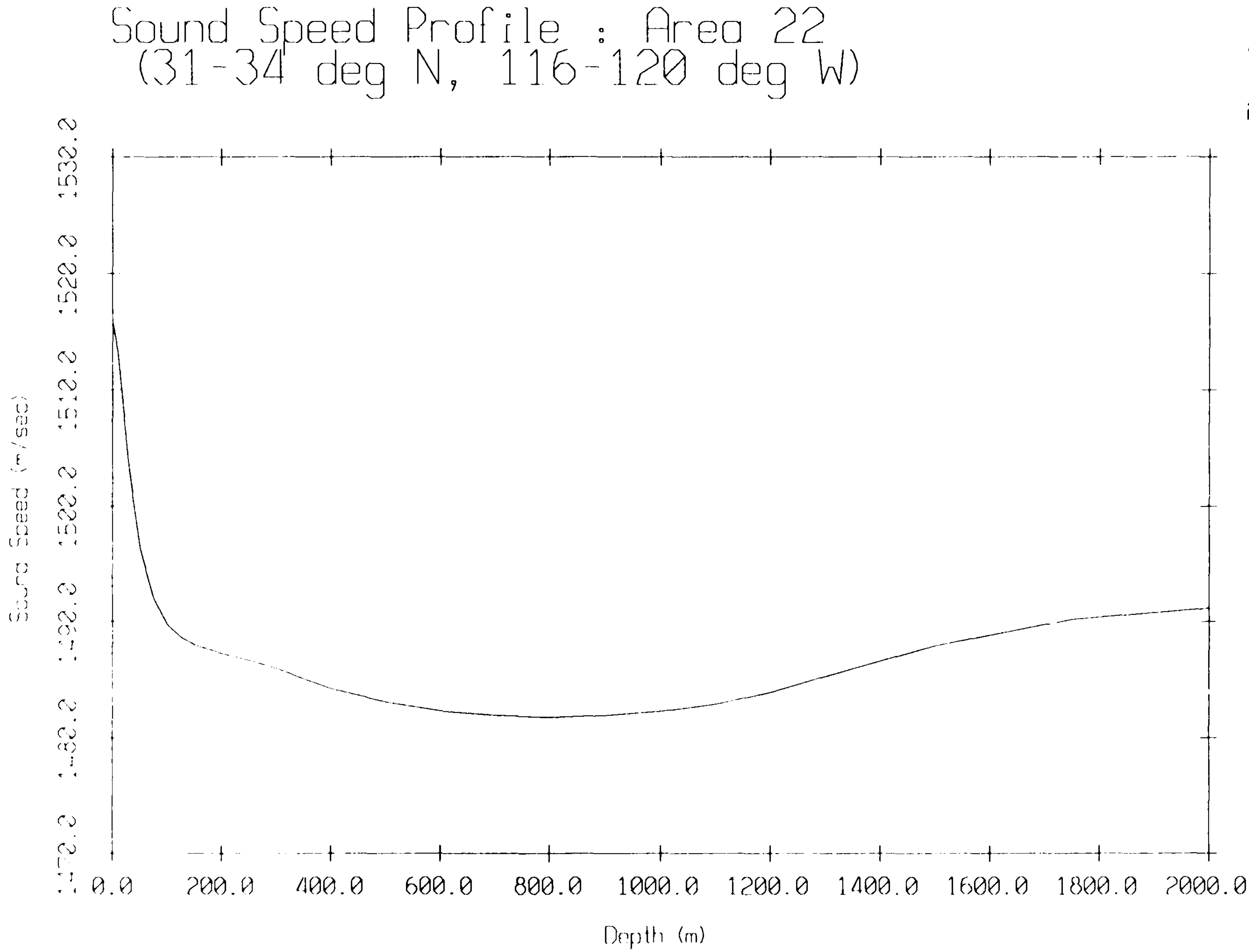

Sound Speed Profile : Area 22
(31-34 deg N, 116-120 deg W)
Sound Speed (m/sec)
1532.0
1522.0
1512.0
1502.0
1492.0
1482.0
1472.0
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
1800.0
2000.0
Depth (m)

Figure 2

August 1987 RUM Deployment Data Screening Results						
record number	internal record number	# of bytes written	first missing resync	pass header checksum?	pass range checksum?	# of failed acoustic checksums?
Float 0						
721	-1	0	0	no	yes	0
722	****	7676	1	no	no	88
1485	-1	2	0	no	yes	0
1544	-1	0	0	no	yes	0
1545	255	7212	1	no	no	84
1981	1976	0	0	yes	yes	0
Float 11						
1	0	7648	1	no	no	88
74	73	6718	0	yes	yes	1
75	128	212	1	no	no	1
371	1792	7644	1	no	no	88
413	0	7646	1	no	no	88
430	0	7646	1	no	no	88
435	0	7648	1	no	no	88
523	520	0	0	yes	yes	0
524	****	7290	1	no	no	85
649	0	7646	1	no	no	88
652	256	7644	1	no	no	88
864	5888	7644	1	no	no	88
987	****	7644	1	no	no	88
1862	1859	7642	60	yes	yes	31
1865	1861	0	0	yes	yes	0

Figure I.1

Float 0, August, 1987 RUM Trip: surface & bottom bounces

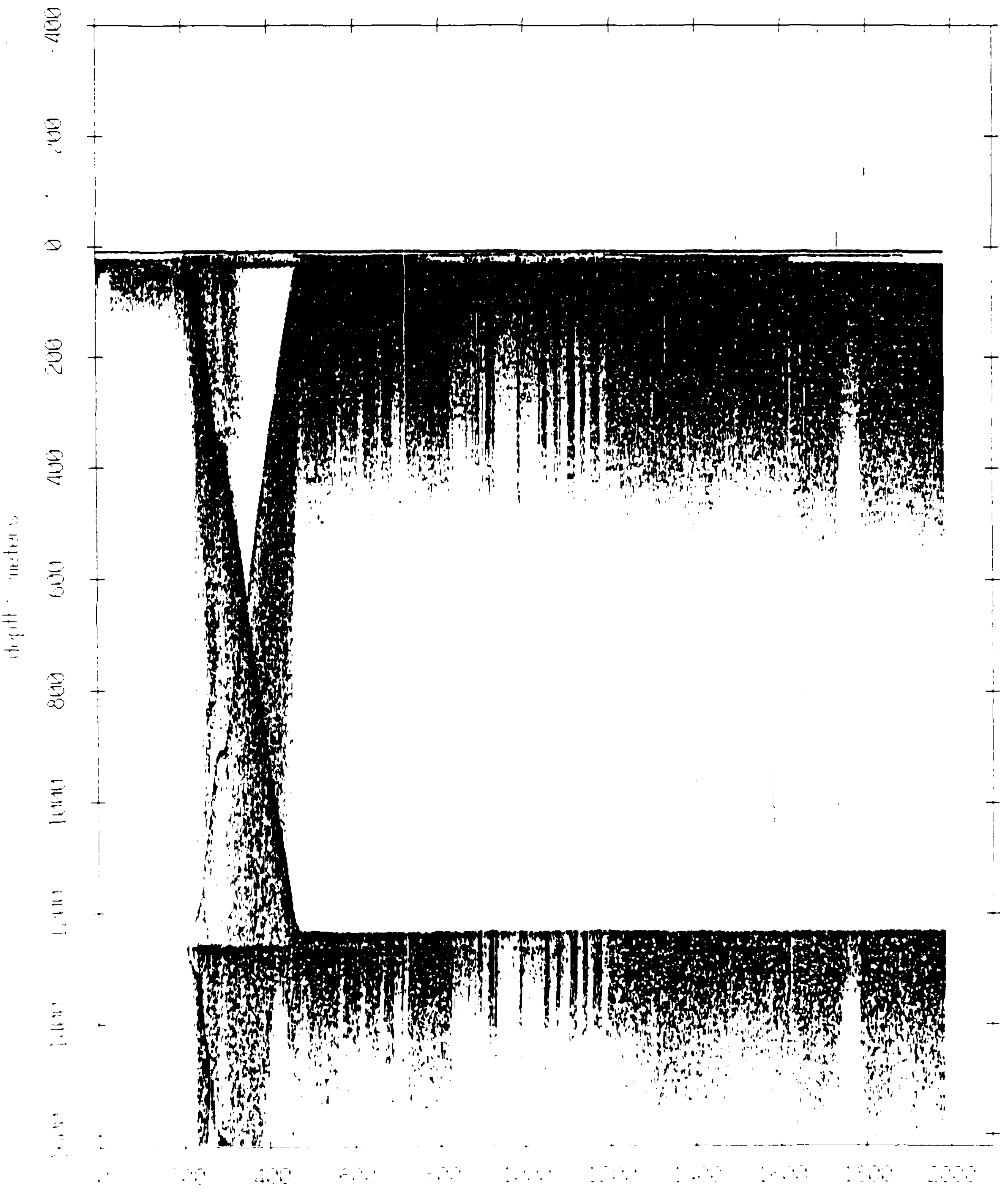


Figure II.1

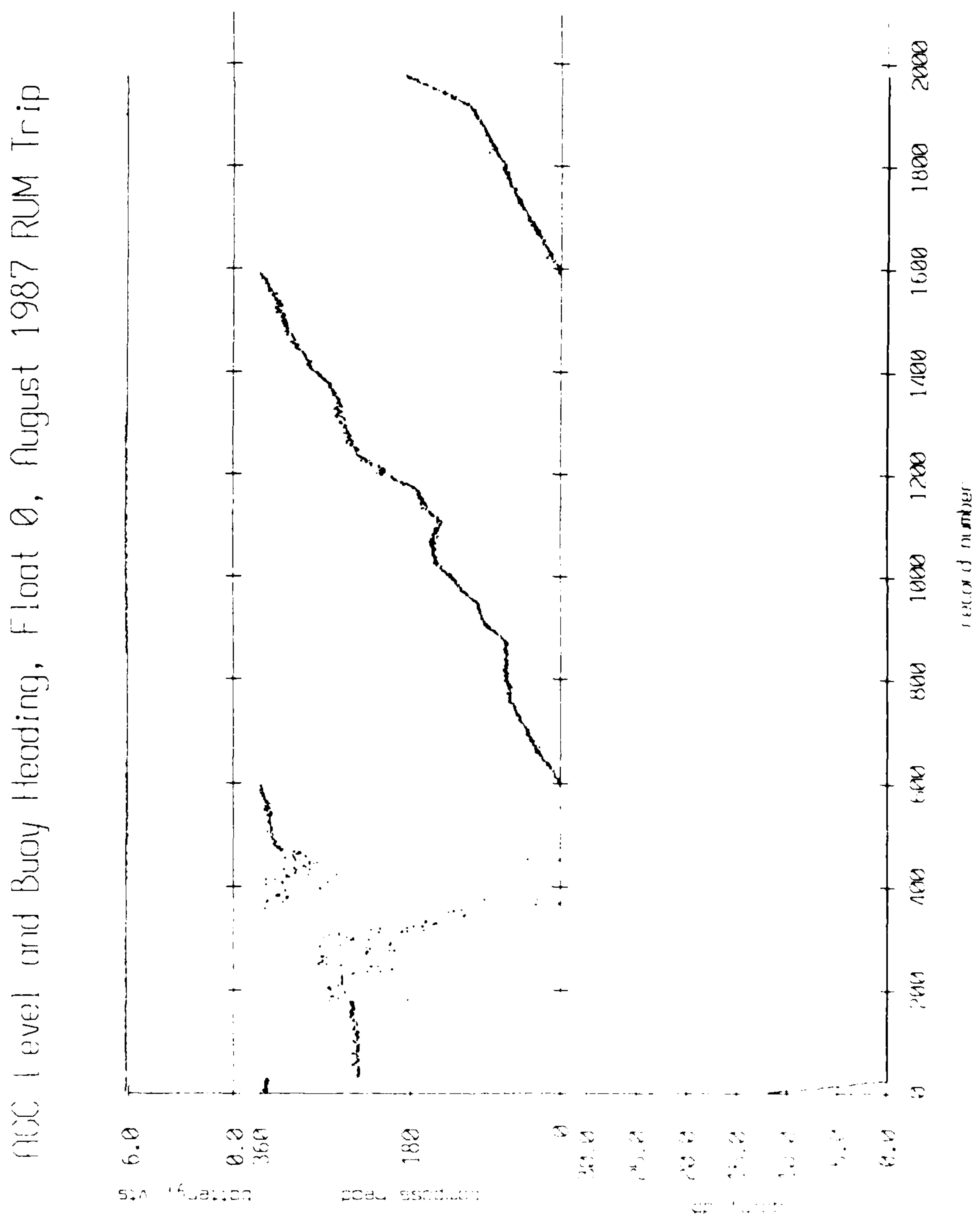

AGC Level and Buoy Heading, Float 0, August 1987 RUM Trip
6.0
0.0
360
180
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000
record number

Figure III.1

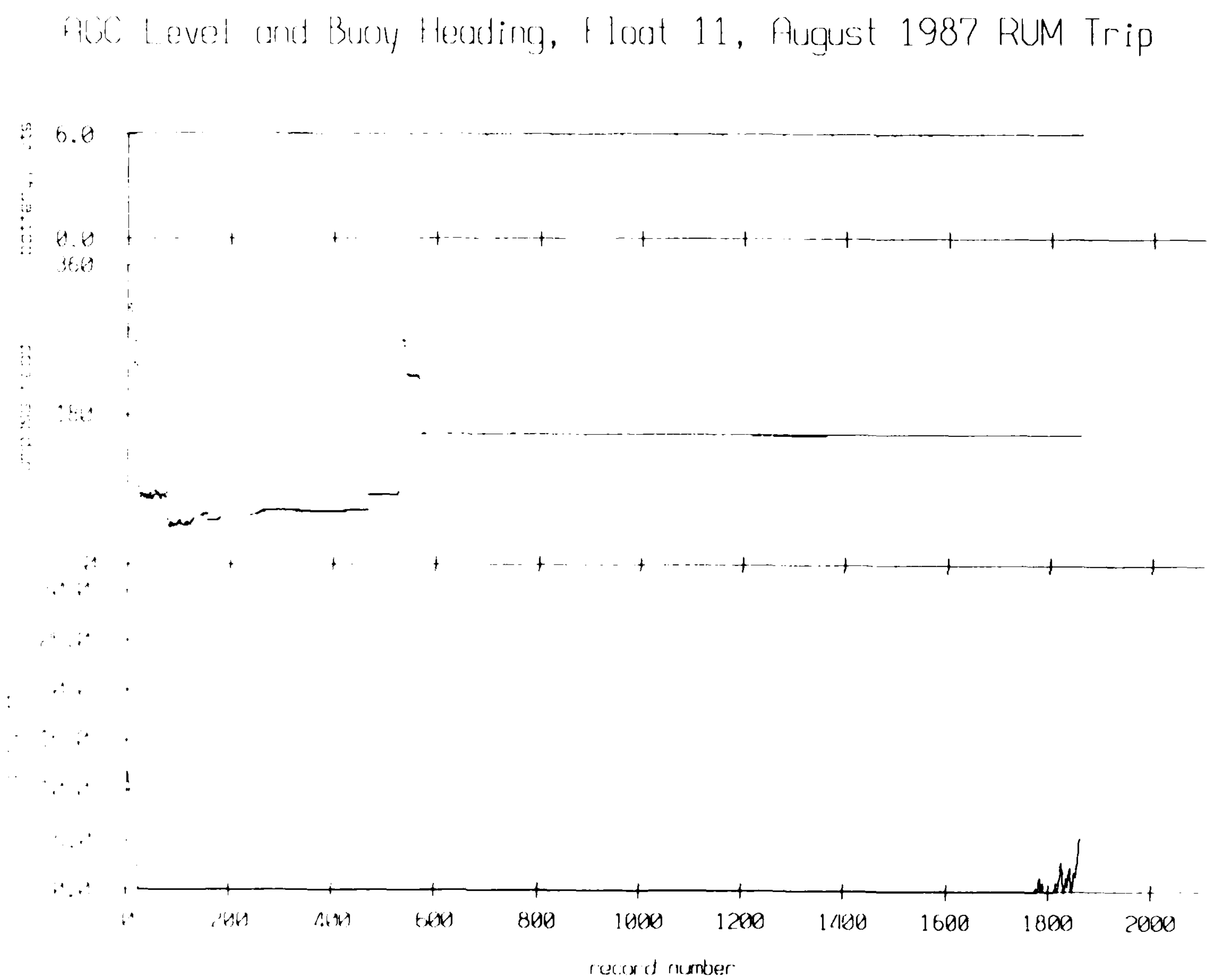

AGC Level and Buoy Heading, Float 11, August 1987 RUM Trip
6.0
0.0
360
180
0
200
400
600
800
1000
1200
1400
1600
1800
2000
record number

Figure III 2

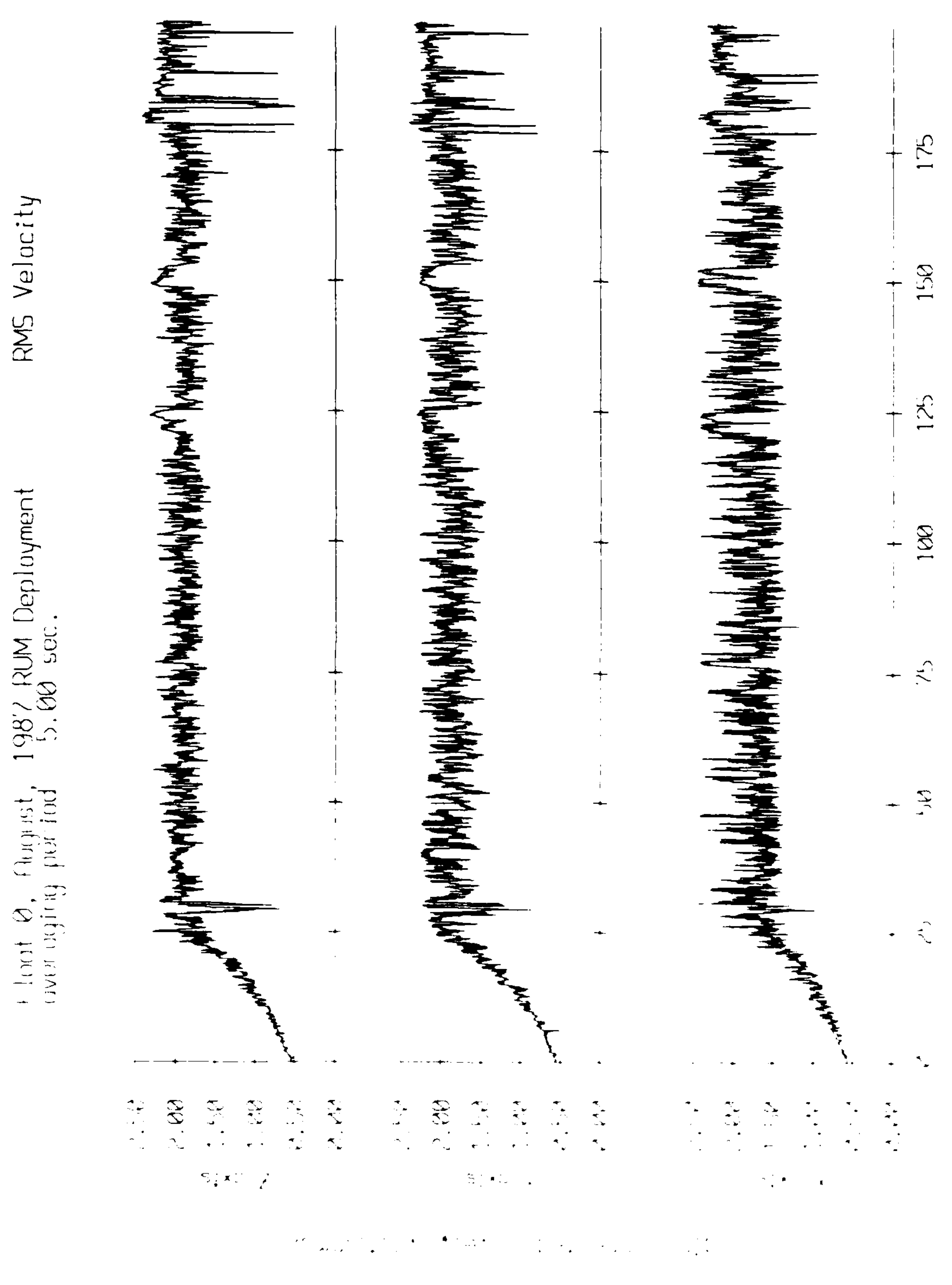

Float 0, August, 1987 RUM Deployment
averaging period 5.00 sec.
RMS Velocity
record number
25
50
75
100
125
150
175

Figure IV 1a

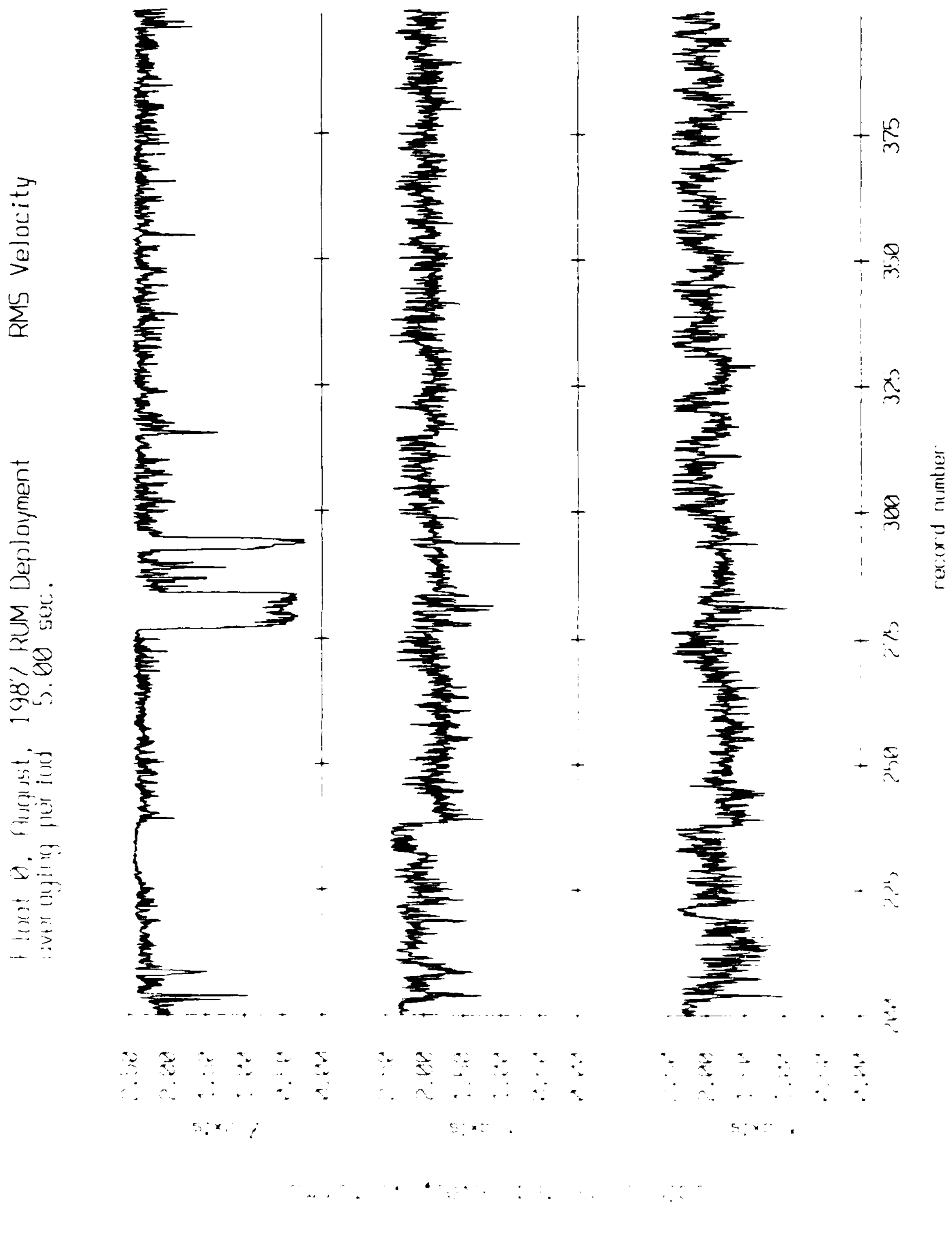
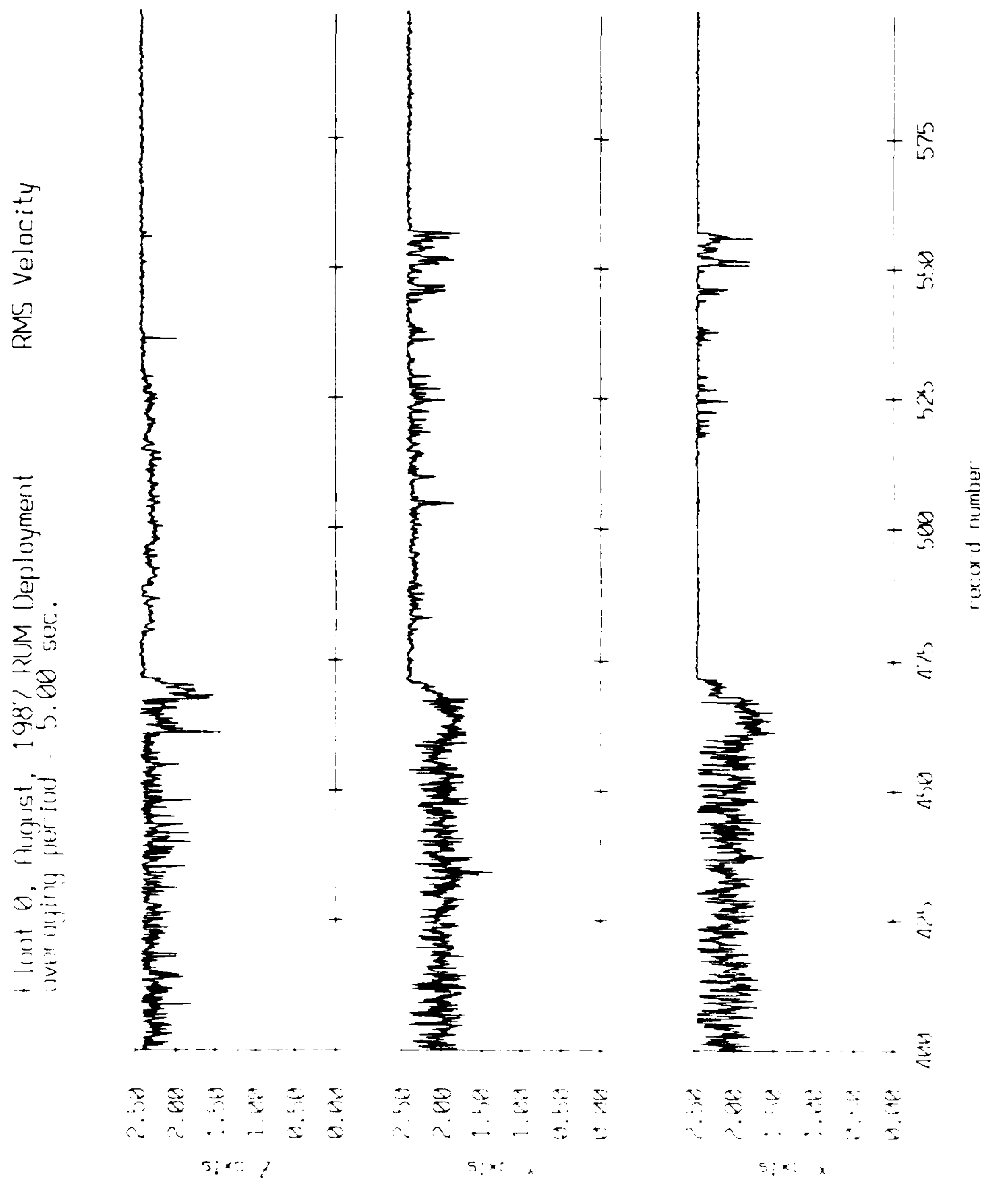
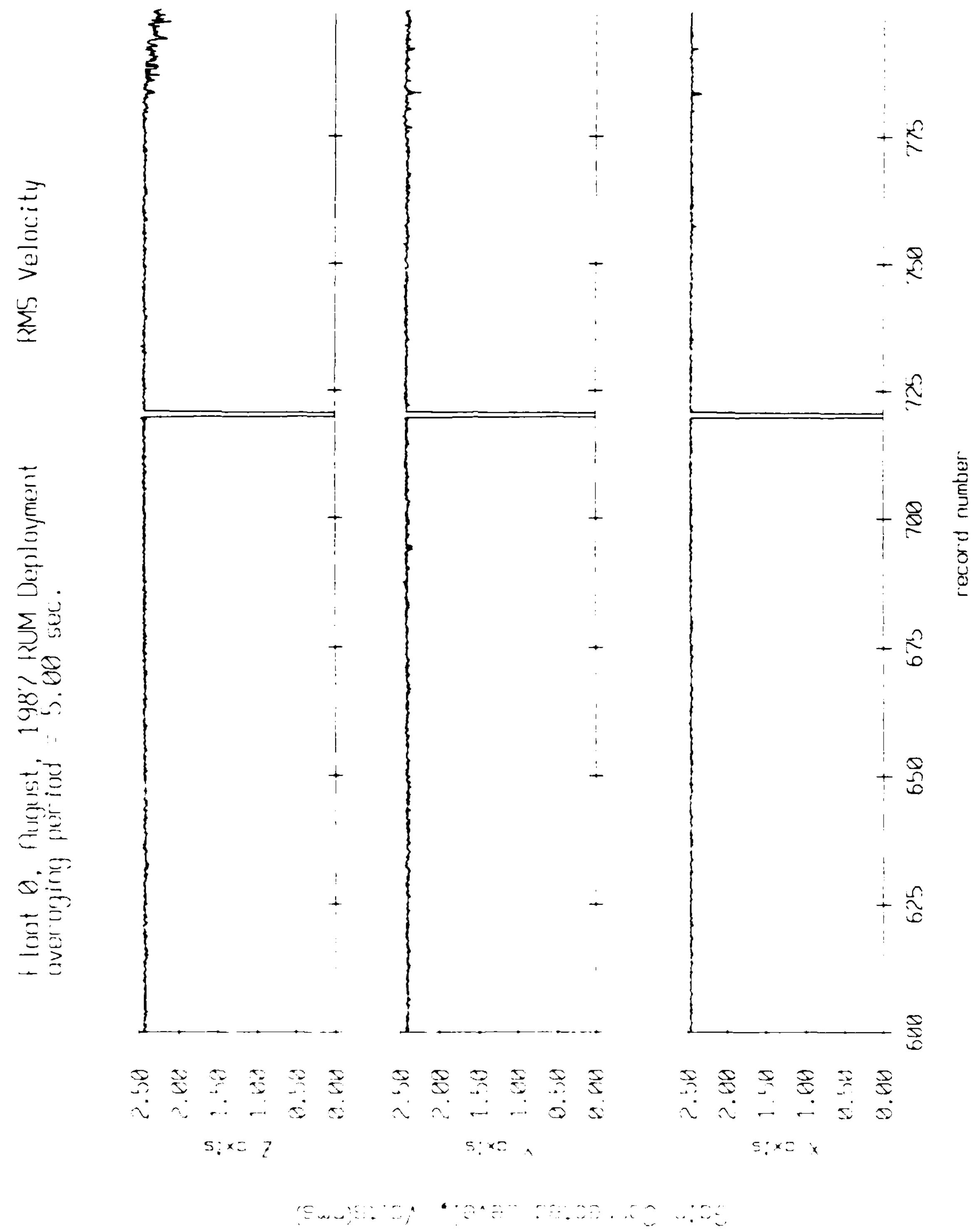

Float 0, August, 1987 RUM Deployment
averaging period 5.00 sec.
RMS Velocity
record number
225
250
275
300
325
350
375

Figure IV 1b



Float 0, August, 1987 RUM Deployment
averaging period : 5.00 sec.
RMS Velocity
record number
400
425
450
475
500
525
550
575
2.50
2.00
1.50
1.00
0.50
0.00

Figure IV.1c



Float 0, August, 1987 RUM Deployment
averaging period = 5.00 sec.
RMS Velocity
2.50
2.00
1.50
1.00
0.50
0.00
z axis
y axis
x axis
600
625
650
675
700
725
750
775
record number

Figure IV.1d

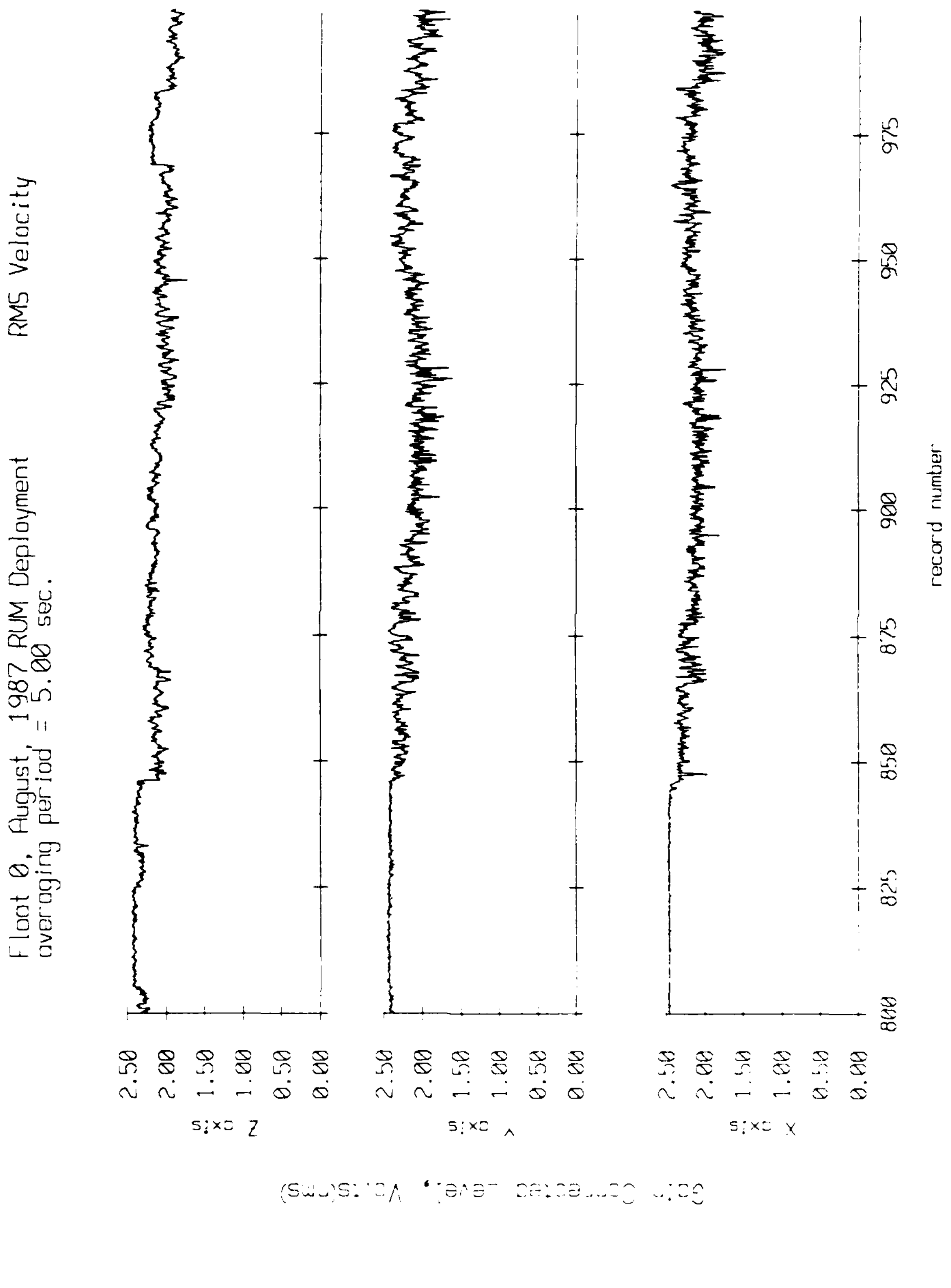

Float 0, August, 1987 RUM Deployment
averaging period = 5.00 sec.
RMS Velocity
Z axis
Y axis
X axis
Gain Corrected Level, Volts(rms)
2.50
2.00
1.50
1.00
0.50
0.00
800
825
850
875
900
925
950
975
record number

Figure IV.1e

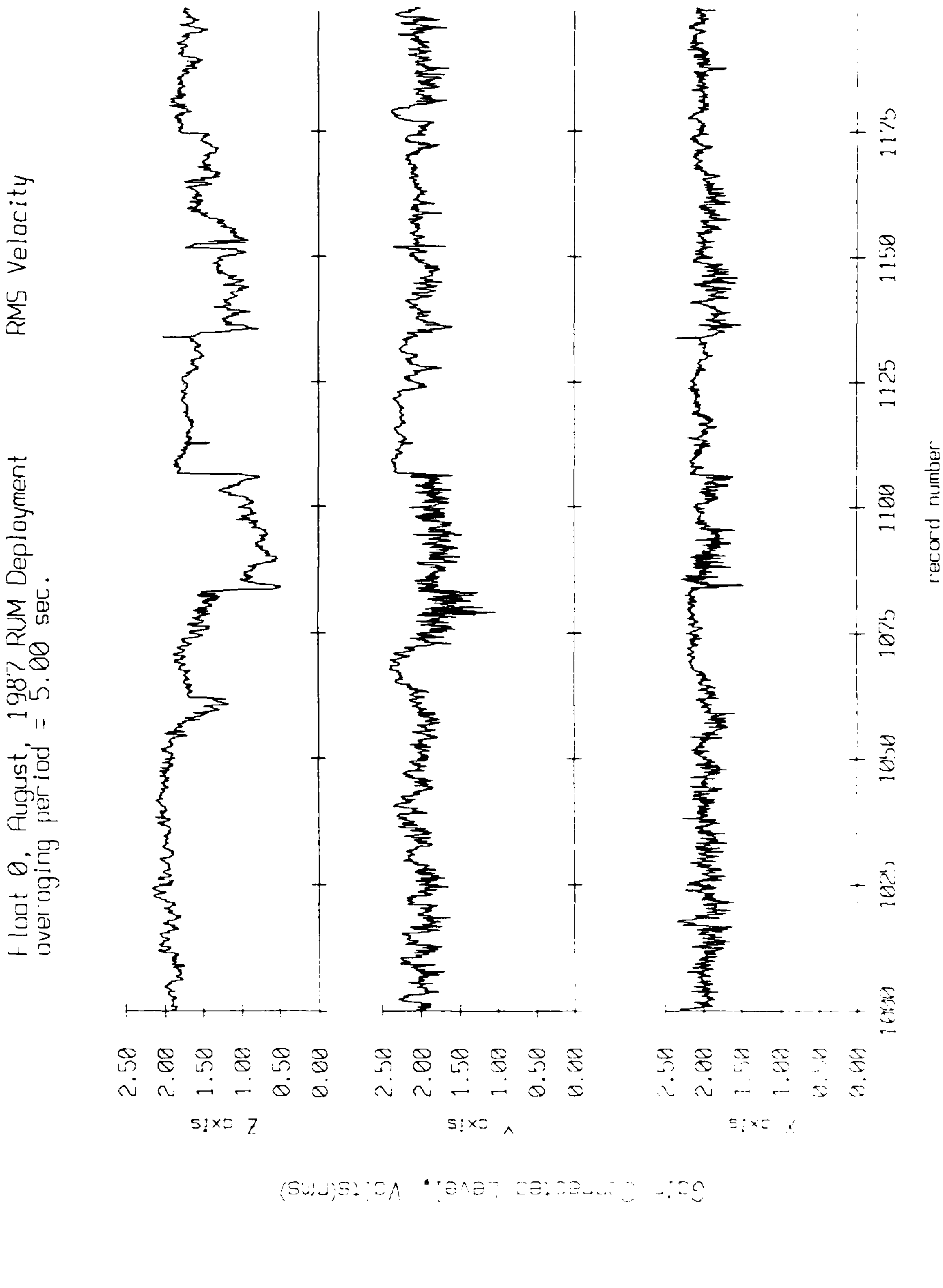

Float 0, August, 1987 RUM Deployment
averaging period = 5.00 sec.
RMS Velocity
record number
Z axis
2.50
2.00
1.50
1.00
0.50
0.00
1000
1025
1050
1075
1100
1125
1150
1175

Figure IV.1f

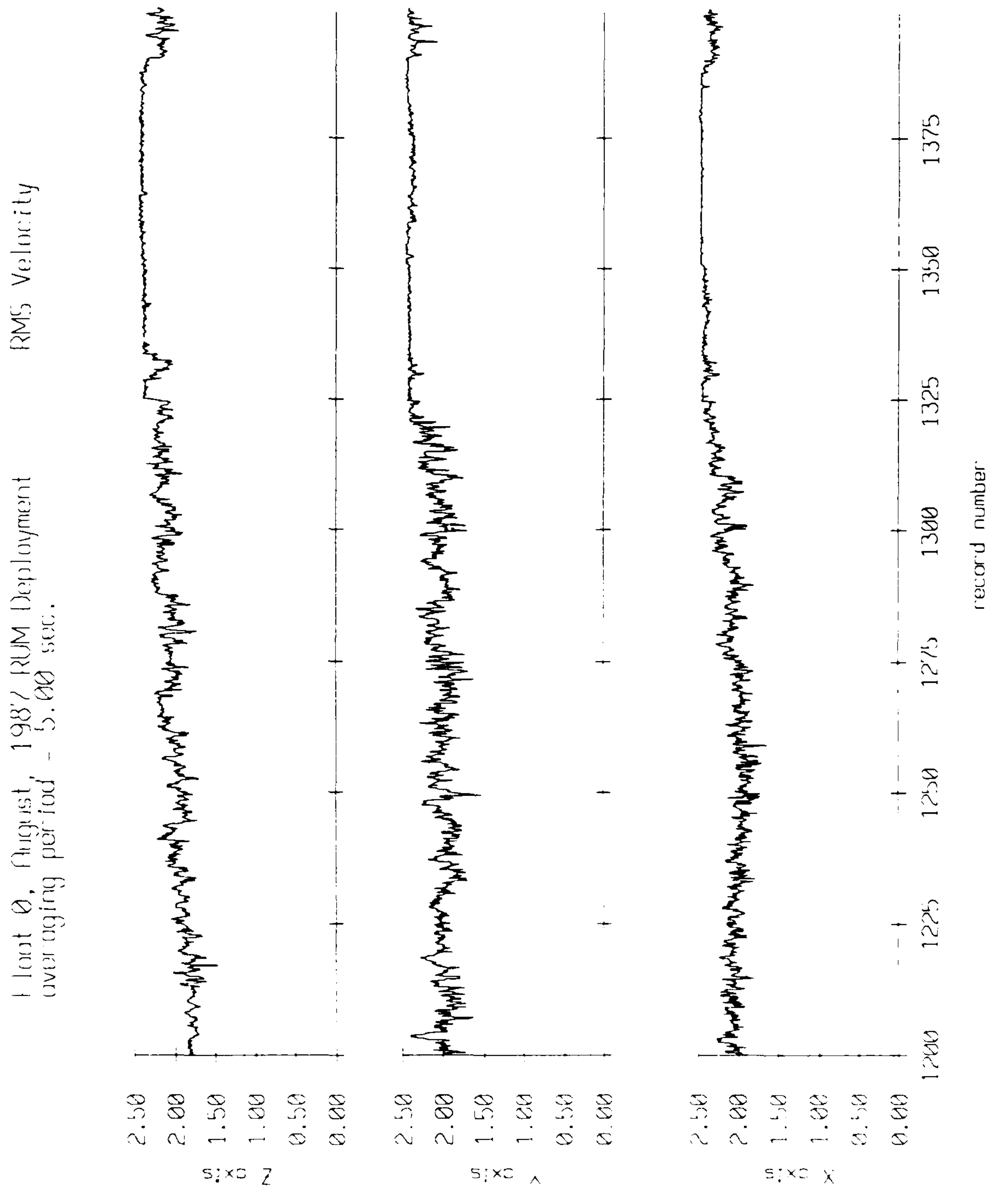
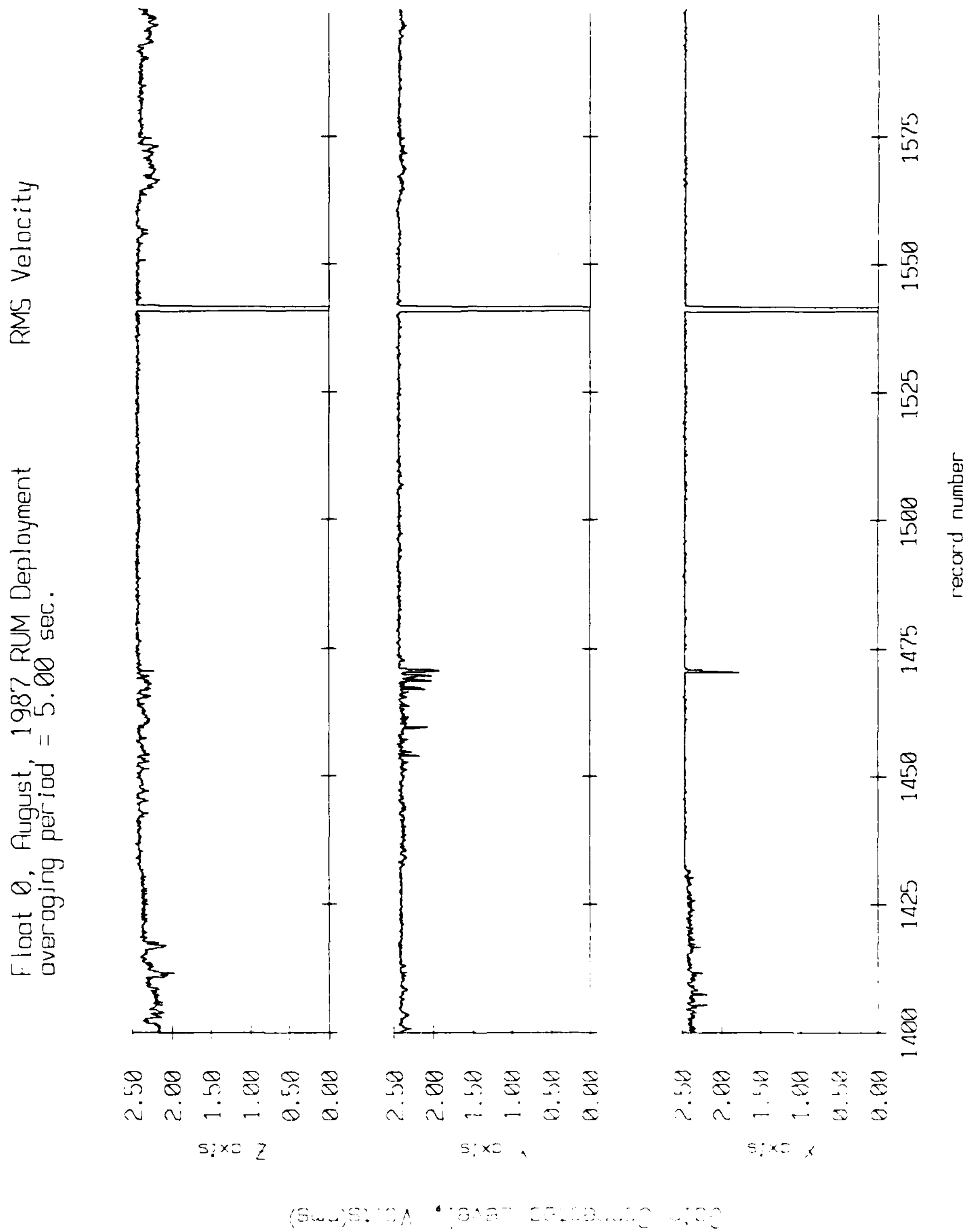

Float 0, August, 1987 RUM Deployment
averaging period - 5.00 sec.
RMS Velocity
Z axis
Y axis
X axis
2.50
2.00
1.50
1.00
0.50
0.00
1200
1225
1250
1275
1300
1325
1350
1375
record number

Figure IV.1g



Float 0, August, 1987 RUM Deployment
averaging period = 5.00 sec.
RMS Velocity
z axis
y axis
x axis
2.50
2.00
1.50
1.00
0.50
0.00
1400
1425
1450
1475
1500
1525
1550
1575
record number

Figure IV.1h

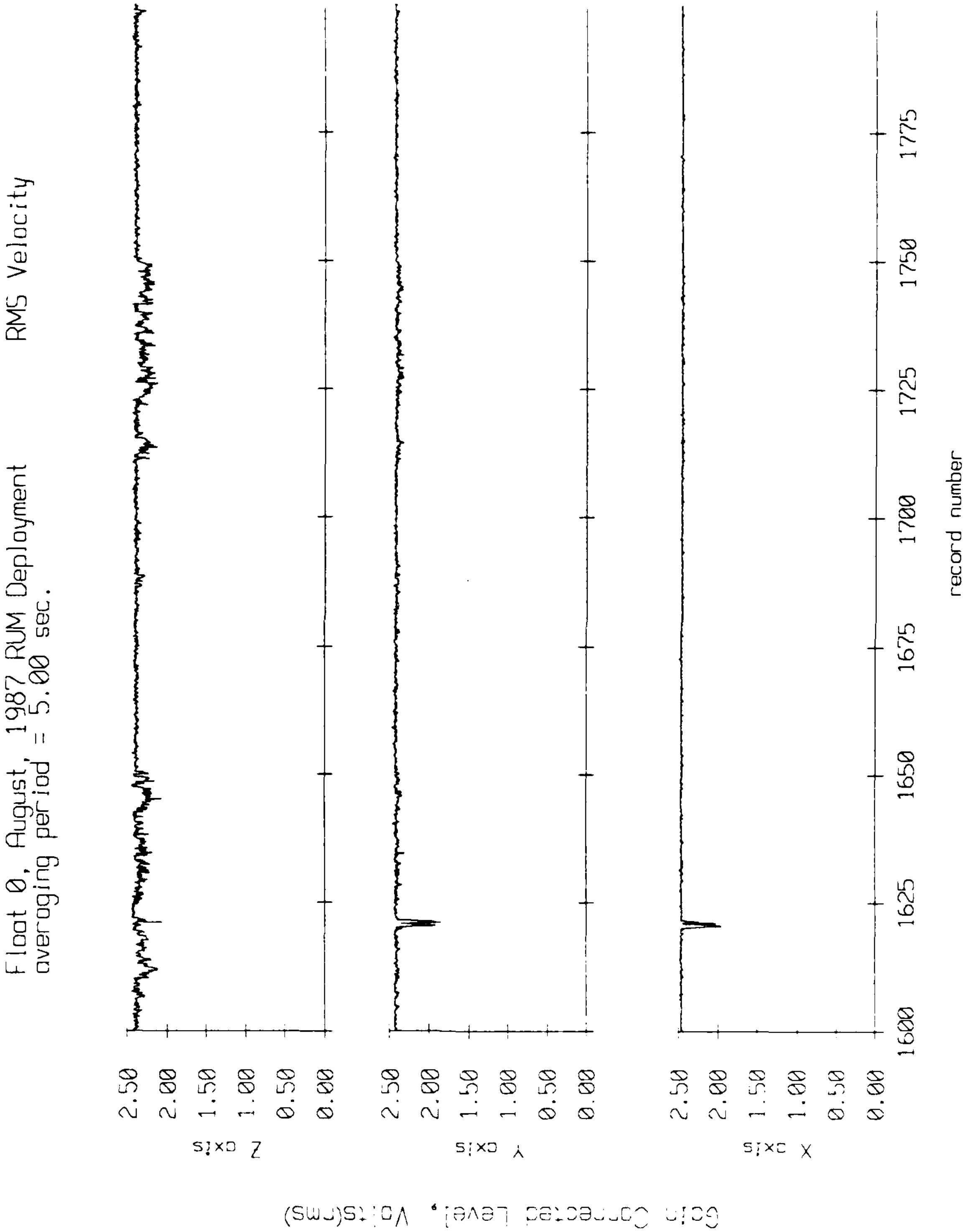
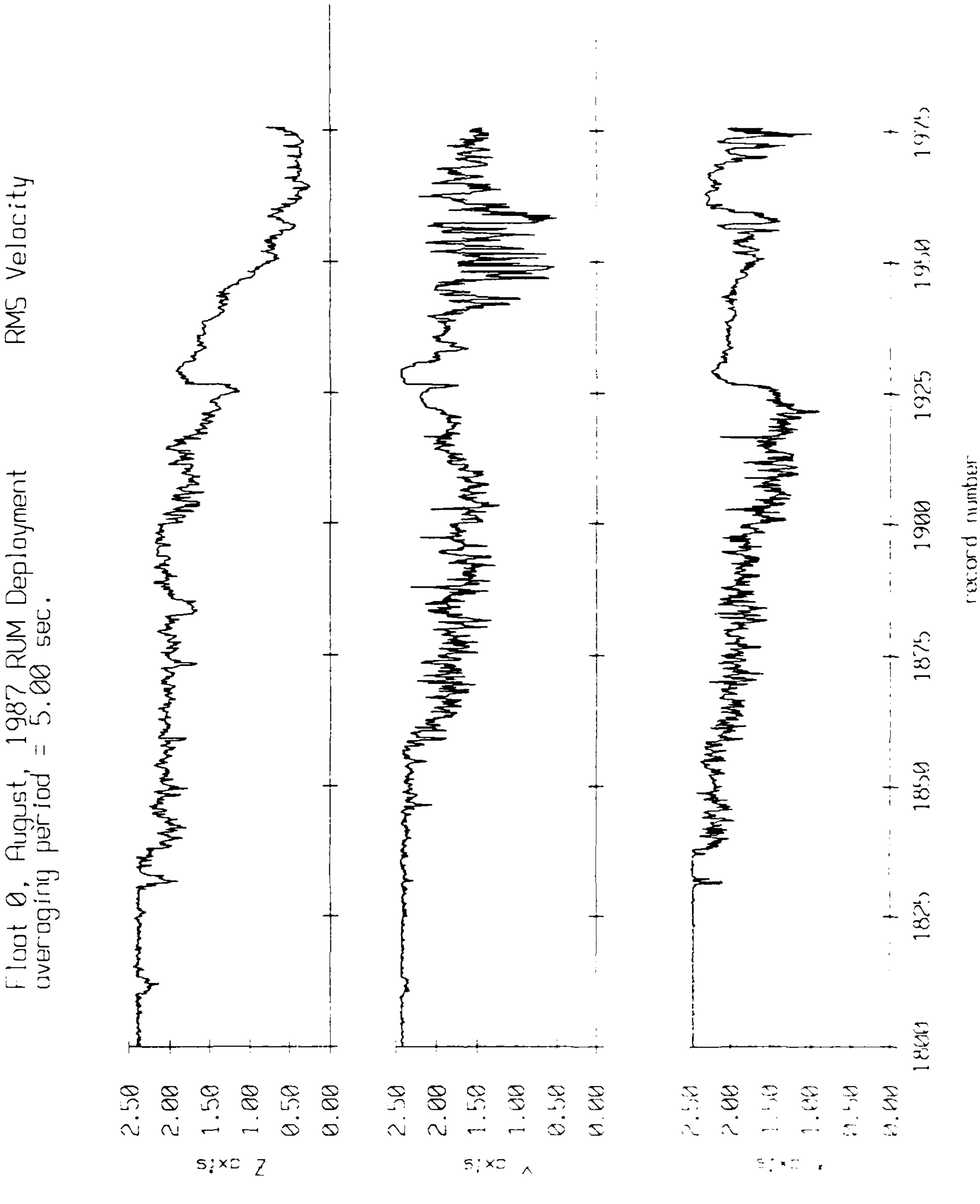

Float 0, August, 1987 RUM Deployment
averaging period = 5.00 sec.
RMS Velocity
Z axis
Y axis
X axis
Gain Corrected Level, Volts(rms)
2.50
2.00
1.50
1.00
0.50
0.00
1600
1625
1650
1675
1700
1725
1750
1775
record number

Figure IV.1i



Float 0, August, 1987 RUM Deployment
averaging period = 5.00 sec.
RMS Velocity
Z axis
Y axis
2.50
2.00
1.50
1.00
0.50
0.00
1800
1825
1850
1875
1900
1925
1950
1975
record number

Figure IV.1j

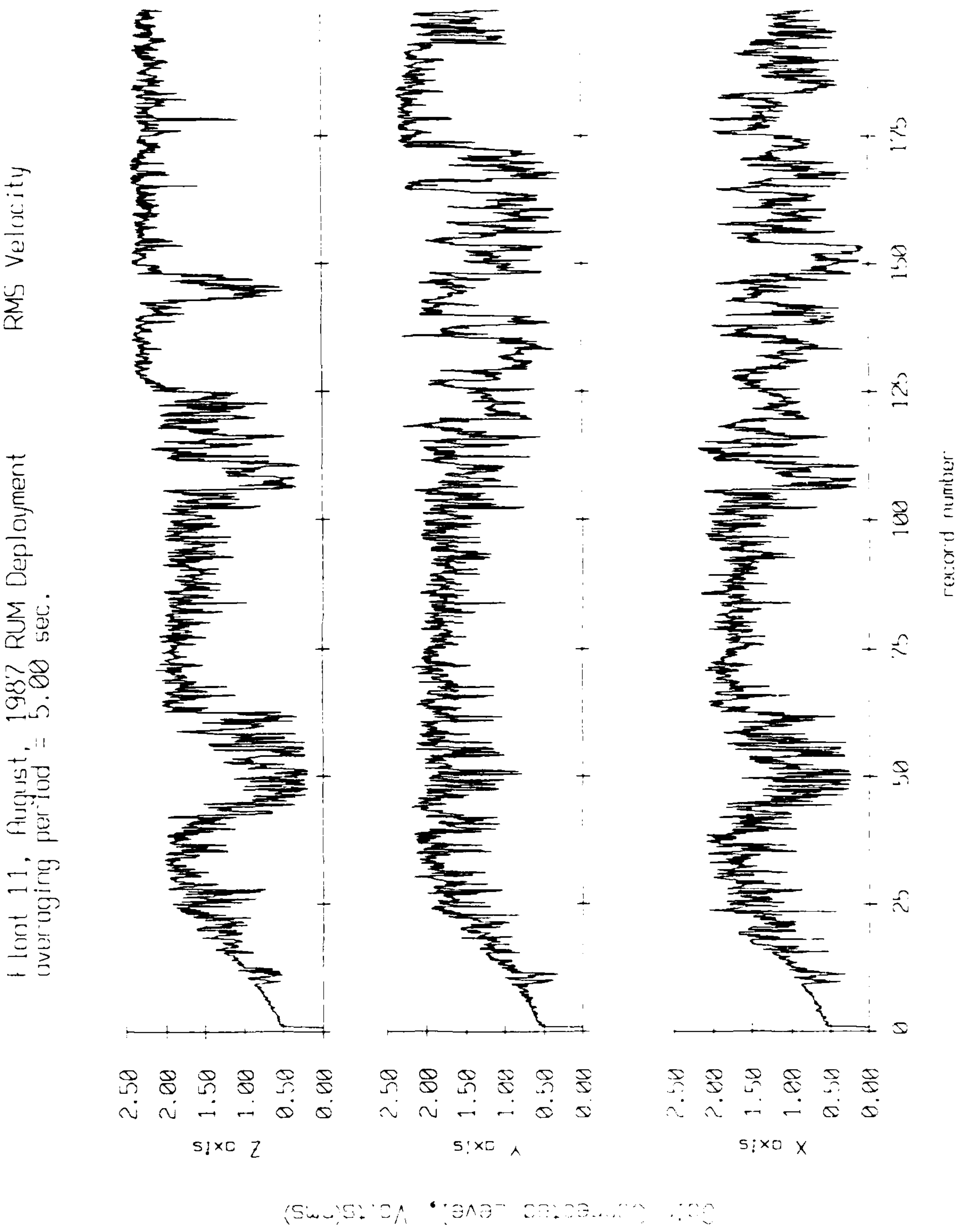

Float 11, August, 1987 RUM Deployment
averaging period = 5.00 sec.
RMS Velocity
Z axis
Y axis
X axis
2.50
2.00
1.50
1.00
0.50
0.00
0
25
50
75
100
125
150
175
record number

Figure IV.2a

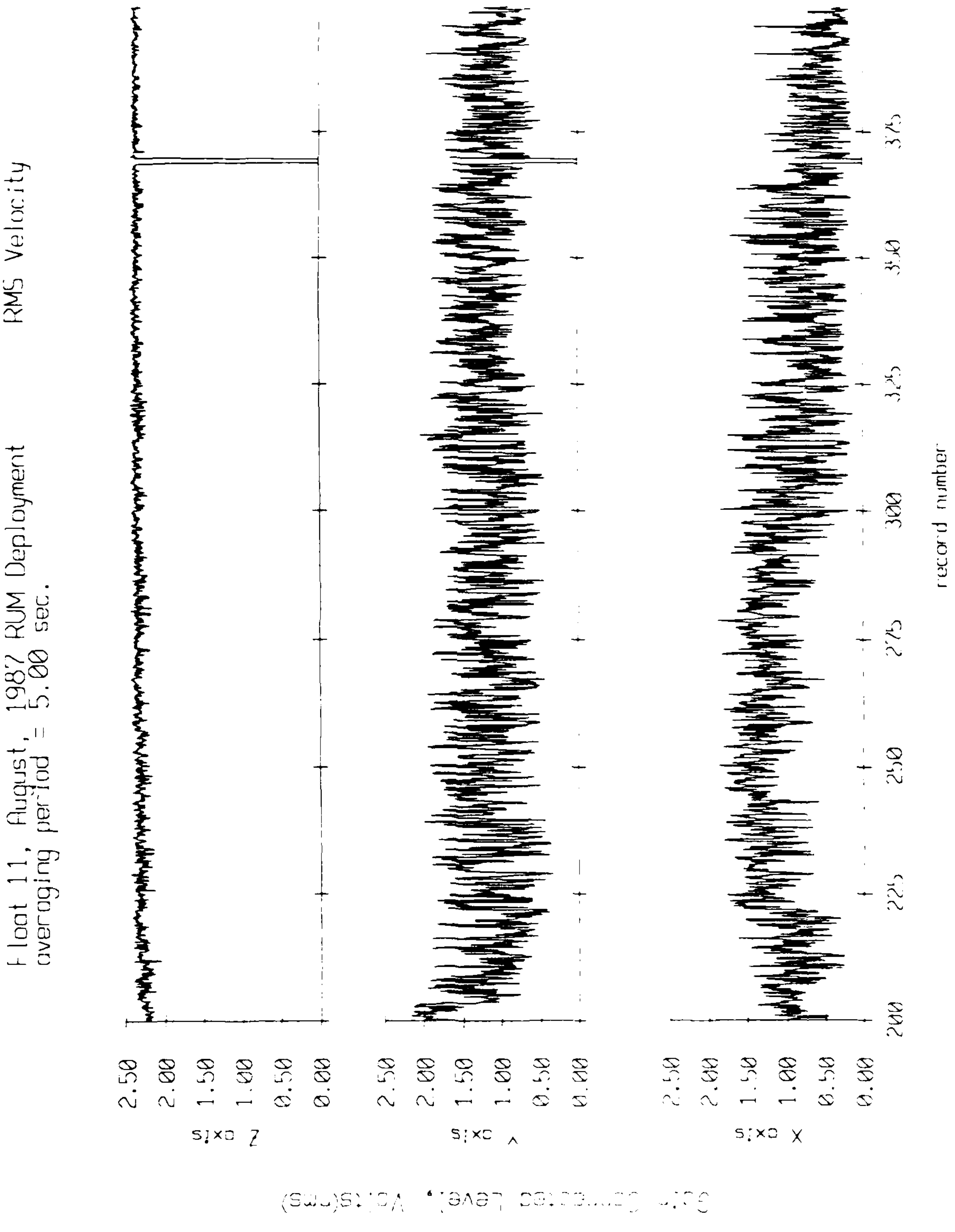

Float 11, August, 1987 RUM Deployment
averaging period = 5.00 sec.
RMS Velocity
Z axis
Y axis
X axis
2.50
2.00
1.50
1.00
0.50
0.00
200
225
250
275
300
325
350
375
record number

Figure IV.2b

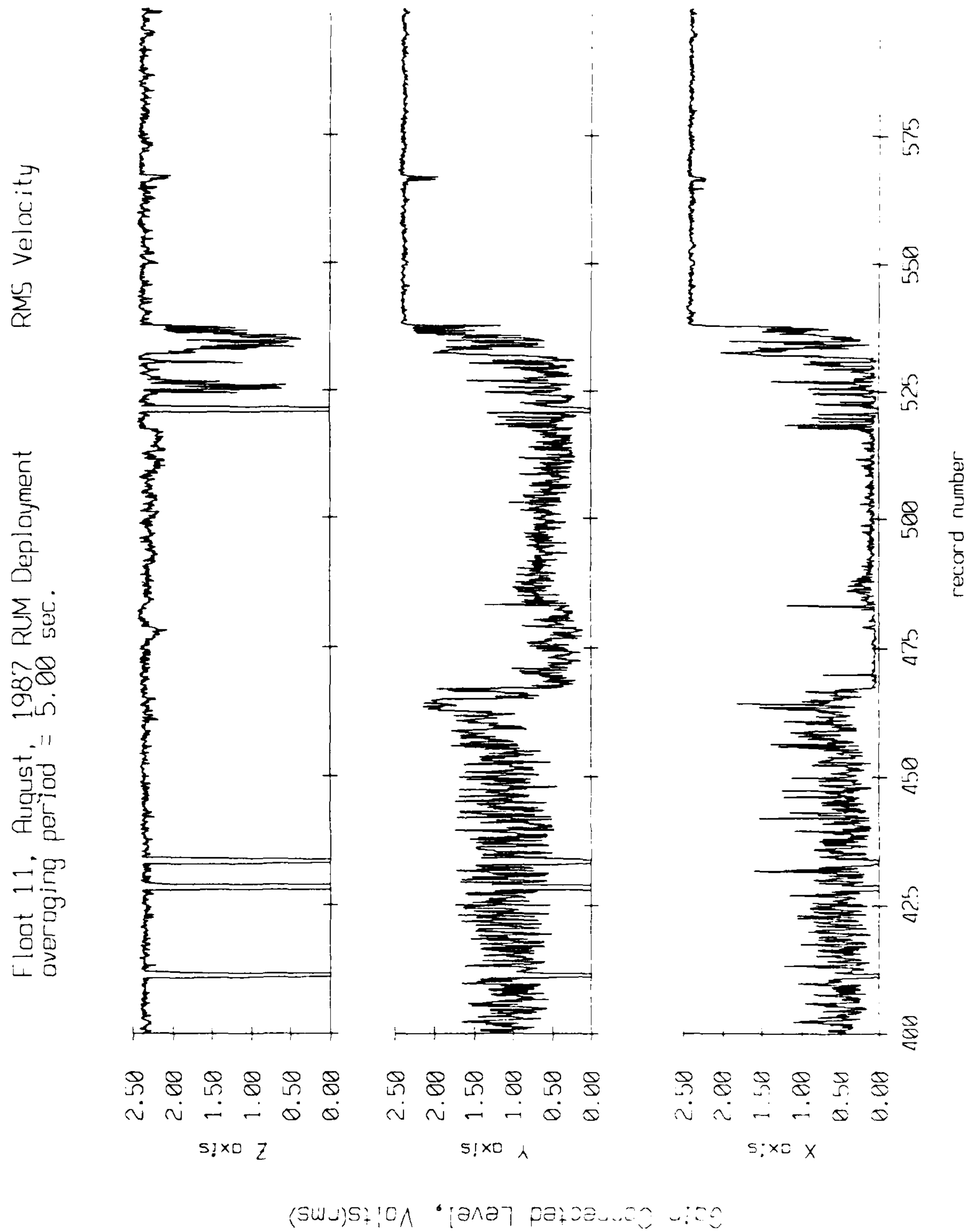
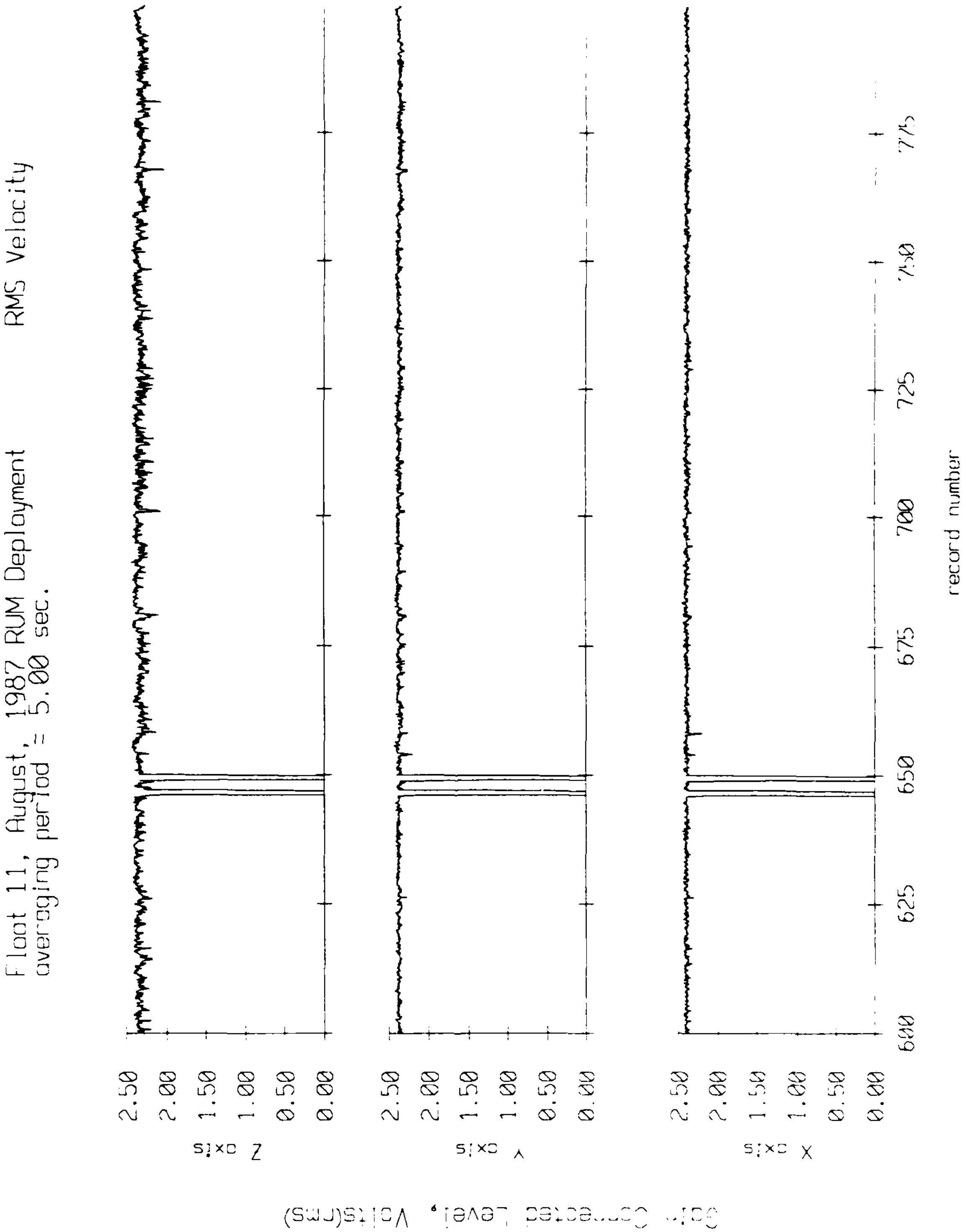

Float 11, August, 1987 RUM Deployment
averaging period = 5.00 sec.
RMS Velocity
Gain Corrected Level, Volts(rms)
Z axis
Y axis
X axis
2.50
2.00
1.50
1.00
0.50
0.00
400
425
450
475
500
525
550
575
record number

Figure IV.2c



Float 11, August, 1987 RUM Deployment
averaging period = 5.00 sec.
RMS Velocity
Z axis
Y axis
X axis
2.50
2.00
1.50
1.00
0.50
0.00
600
625
650
675
700
725
750
775
record number
Gain Corrected Level, Volts(rms)

Figure IV.2d

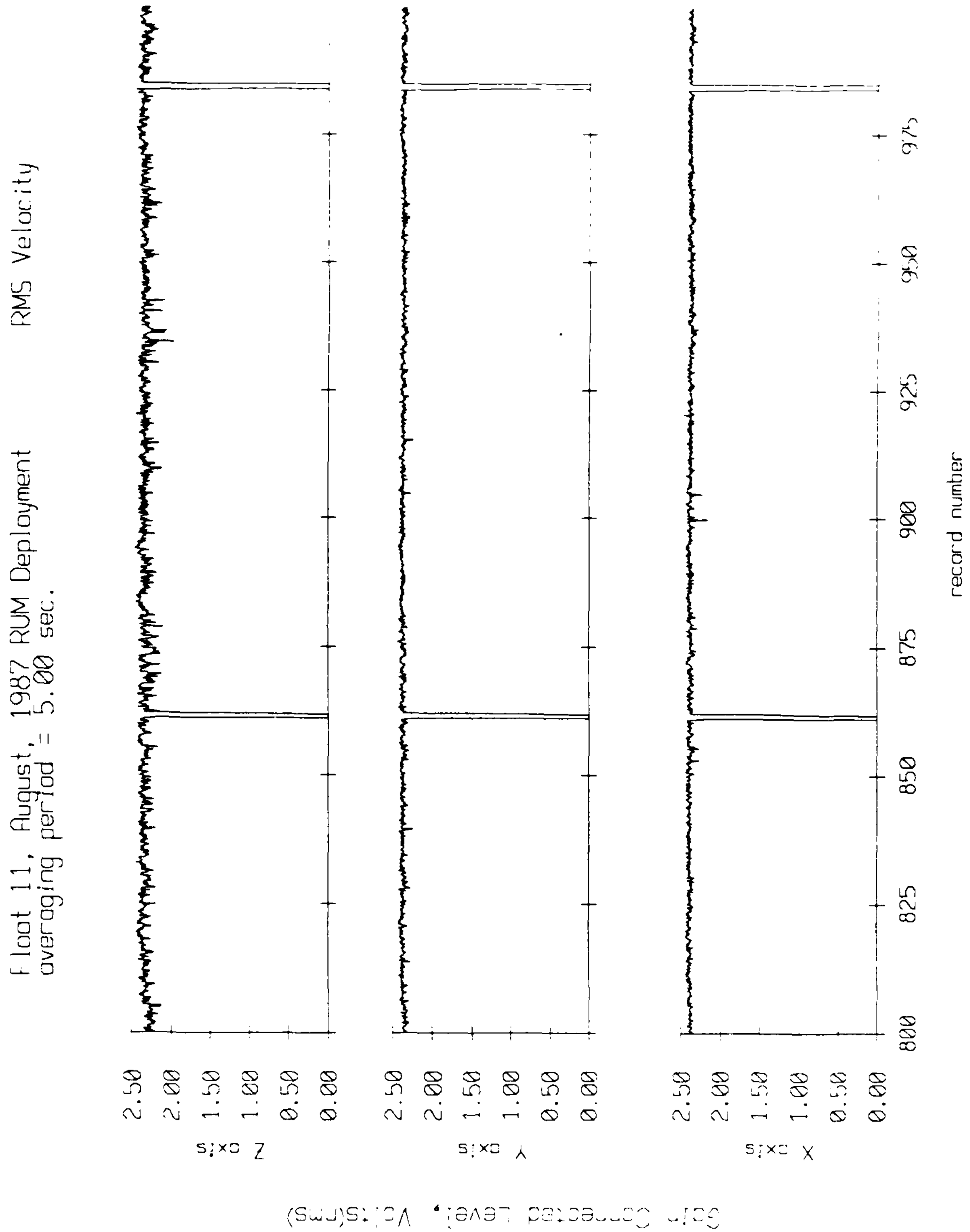
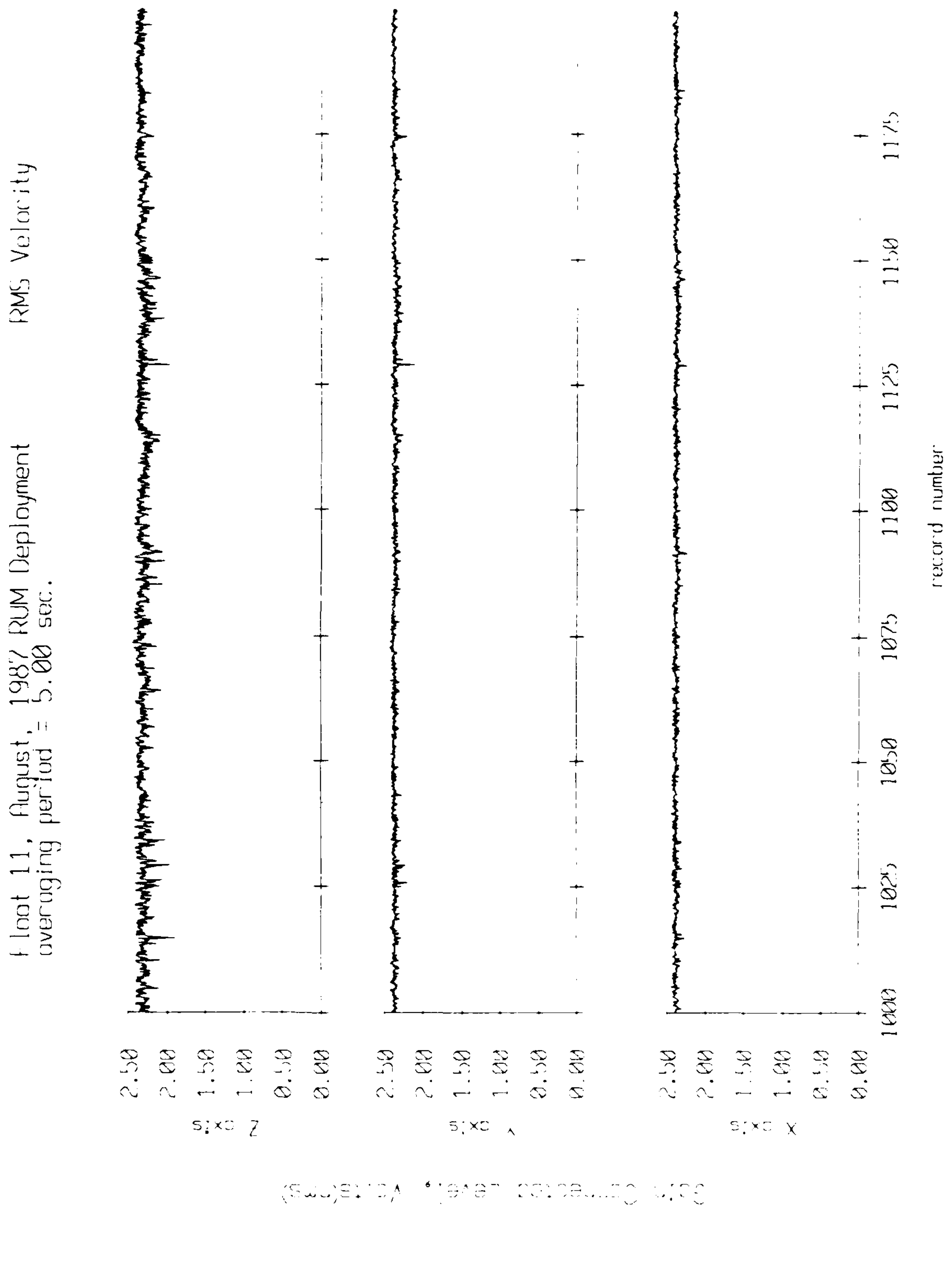
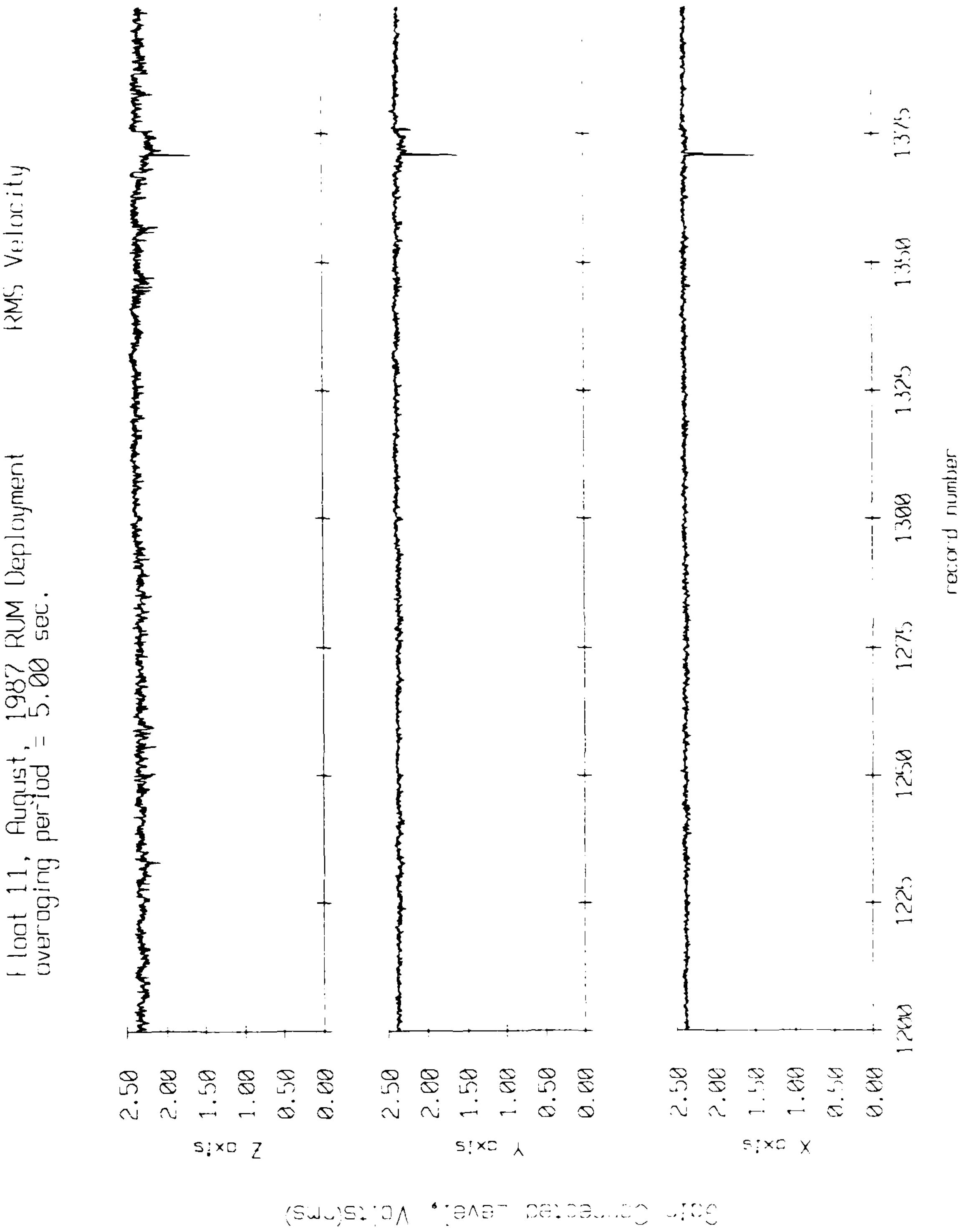

Float 11, August, 1987 RUM Deployment
averaging period = 5.00 sec.
RMS Velocity
Z axis
Y axis
X axis
Gain Corrected Level, Volts(rms)
2.50
2.00
1.50
1.00
0.50
0.00
record number
800
825
850
875
900
925
950
975

Figure IV.2e



Float 11, August, 1987 RUM Deployment
averaging period = 5.00 sec.
RMS Velocity
Z axis
Y axis
X axis
2.50
2.00
1.50
1.00
0.50
0.00
1000
1025
1050
1075
1100
1125
1150
1175
record number

Figure IV.2f



Float 11, August, 1987 RUM Deployment
averaging period = 5.00 sec.
RMS Velocity
Z axis
Y axis
X axis
2.50
2.00
1.50
1.00
0.50
0.00
1200
1225
1250
1275
1300
1325
1350
1375
record number
Gain Corrected Level, Volts(rms)

Figure IV.2g

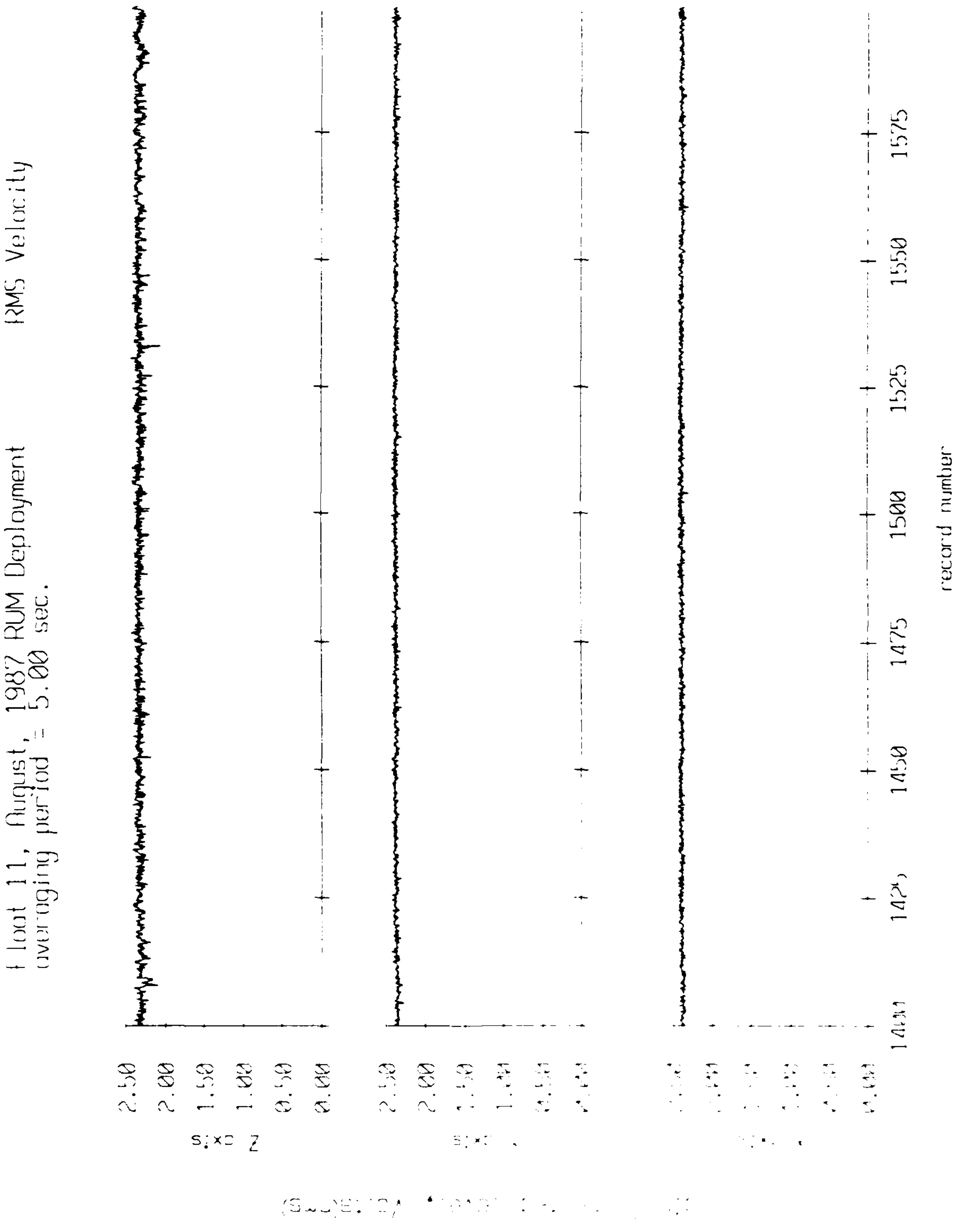
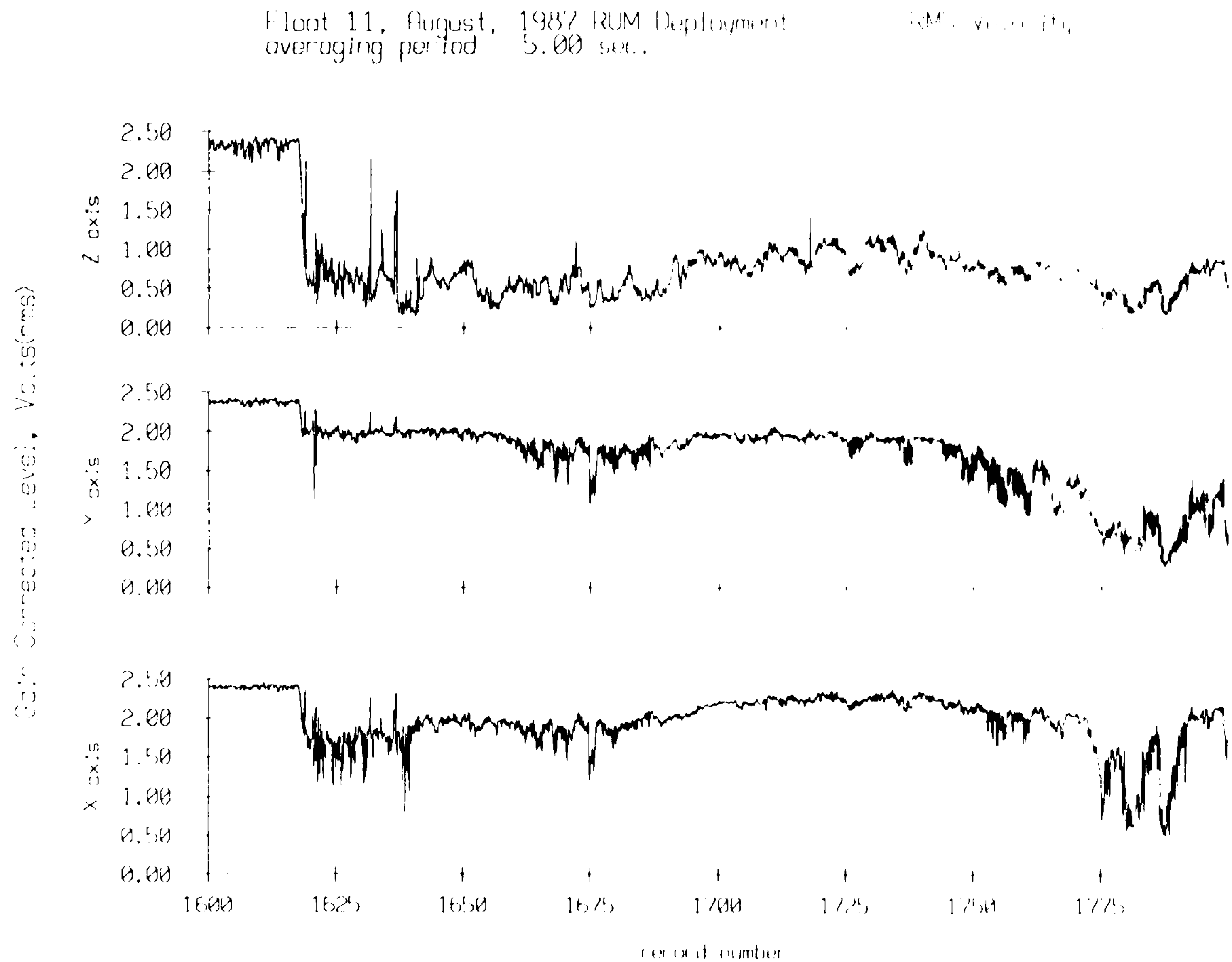

Float 11, August, 1987 RUM Deployment
averaging period = 5.00 sec.
RMS Velocity
Z axis
2.50
2.00
1.50
1.00
0.50
0.00
1450
1475
1500
1525
1550
1575
record number

Figure IV.2h



Float 11, August, 1987 RUM Deployment
averaging period 5.00 sec.
Gain Corrected Level, Volts(rms)
Z axis
Y axis
X axis
2.50
2.00
1.50
1.00
0.50
0.00
1600
1625
1650
1675
1700
1725
1750
1775
record number

Figure IV.2i

Float 11, August, 1987 RUM Deployment   RMS Velocity
averaging period = 5.00 sec.

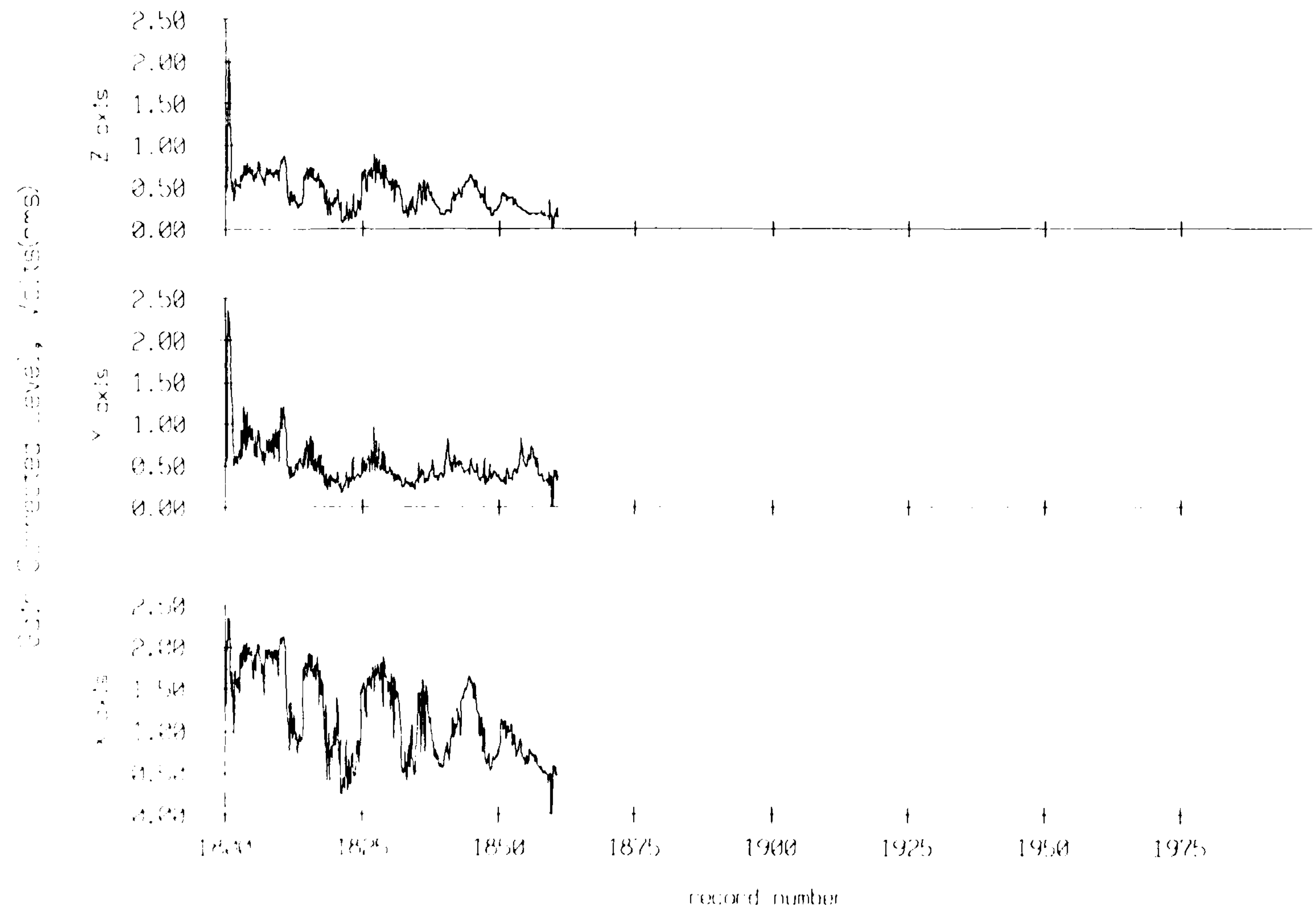


Figure IV.2j

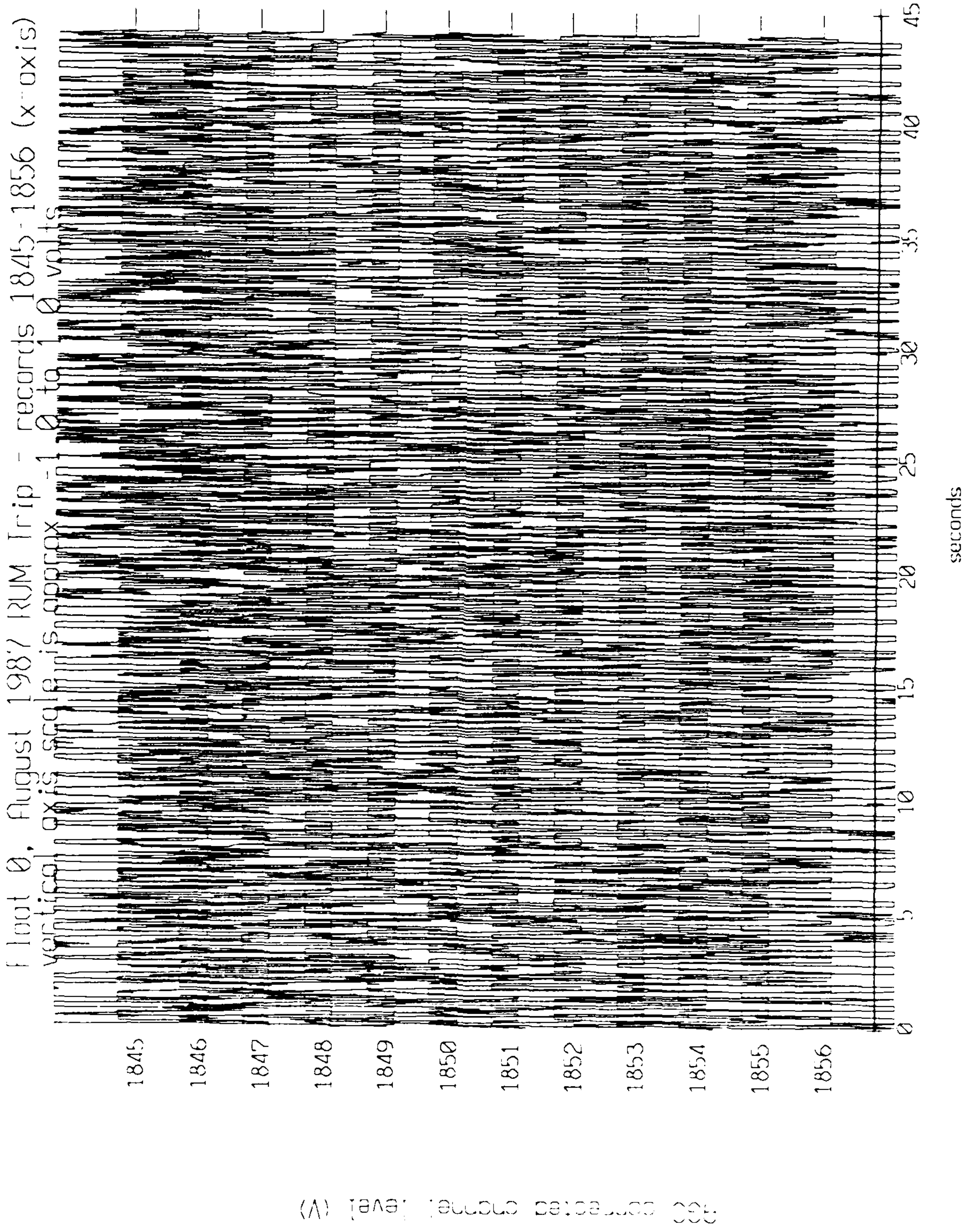

Float 0, August 1987 RUM Trip - records 1845-1856 (x-axis)
vertical axis scale is approx -1.0 to 1.0 volts
0
5
10
15
20
25
30
35
40
45
seconds
1845
1846
1847
1848
1849
1850
1851
1852
1853
1854
1855
1856
corrected channel level (V)

Figure V.1a

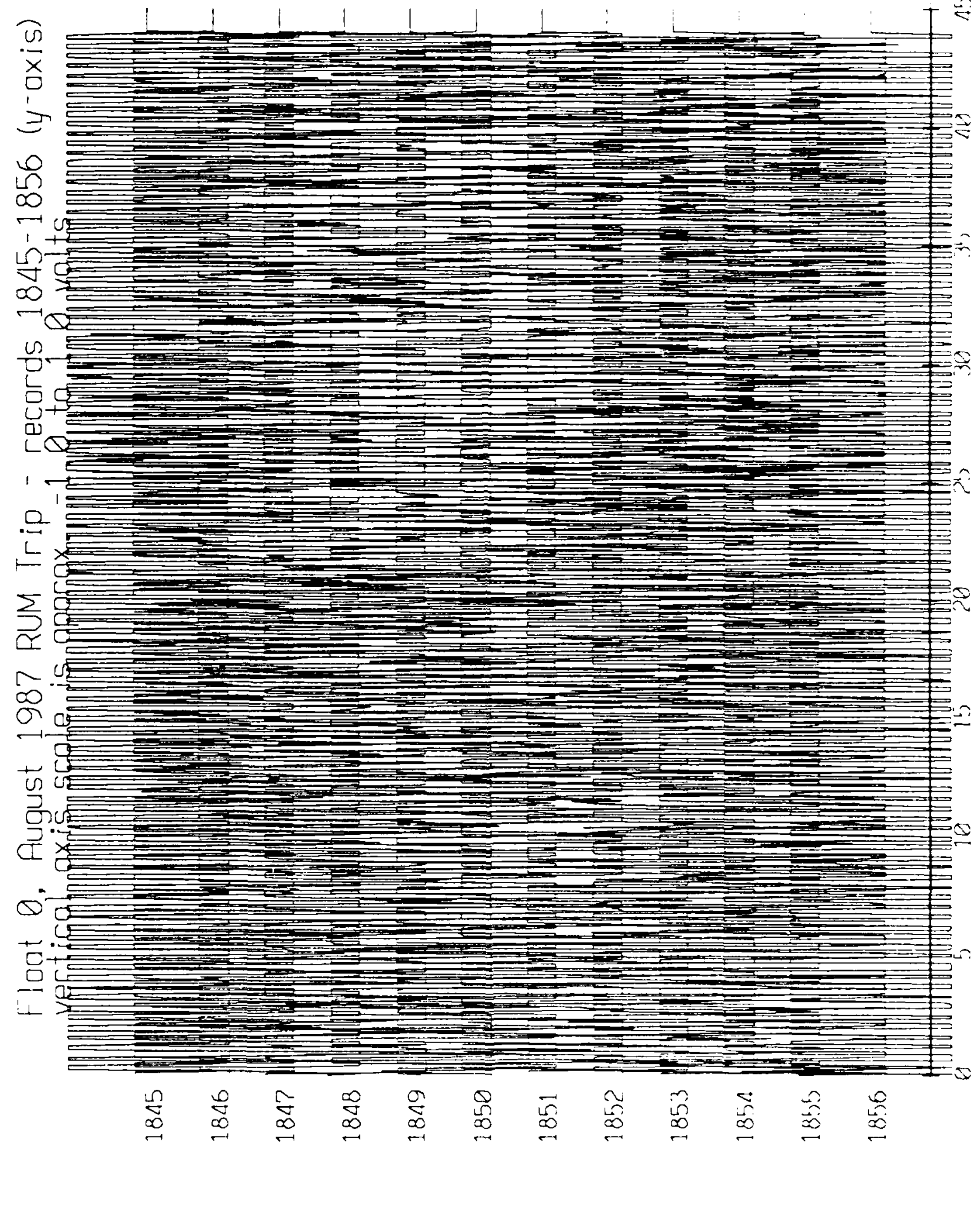

Float 0, August 1987 RUM Trip - records 1845-1856 (y-axis)
vertical axis scale is approx -1.0 to 1.0 volts
DOC corrected channel level (V)
seconds
0
5
10
15
20
25
30
35
40
45
1845
1846
1847
1848
1849
1850
1851
1852
1853
1854
1855
1856

Figure V.1b

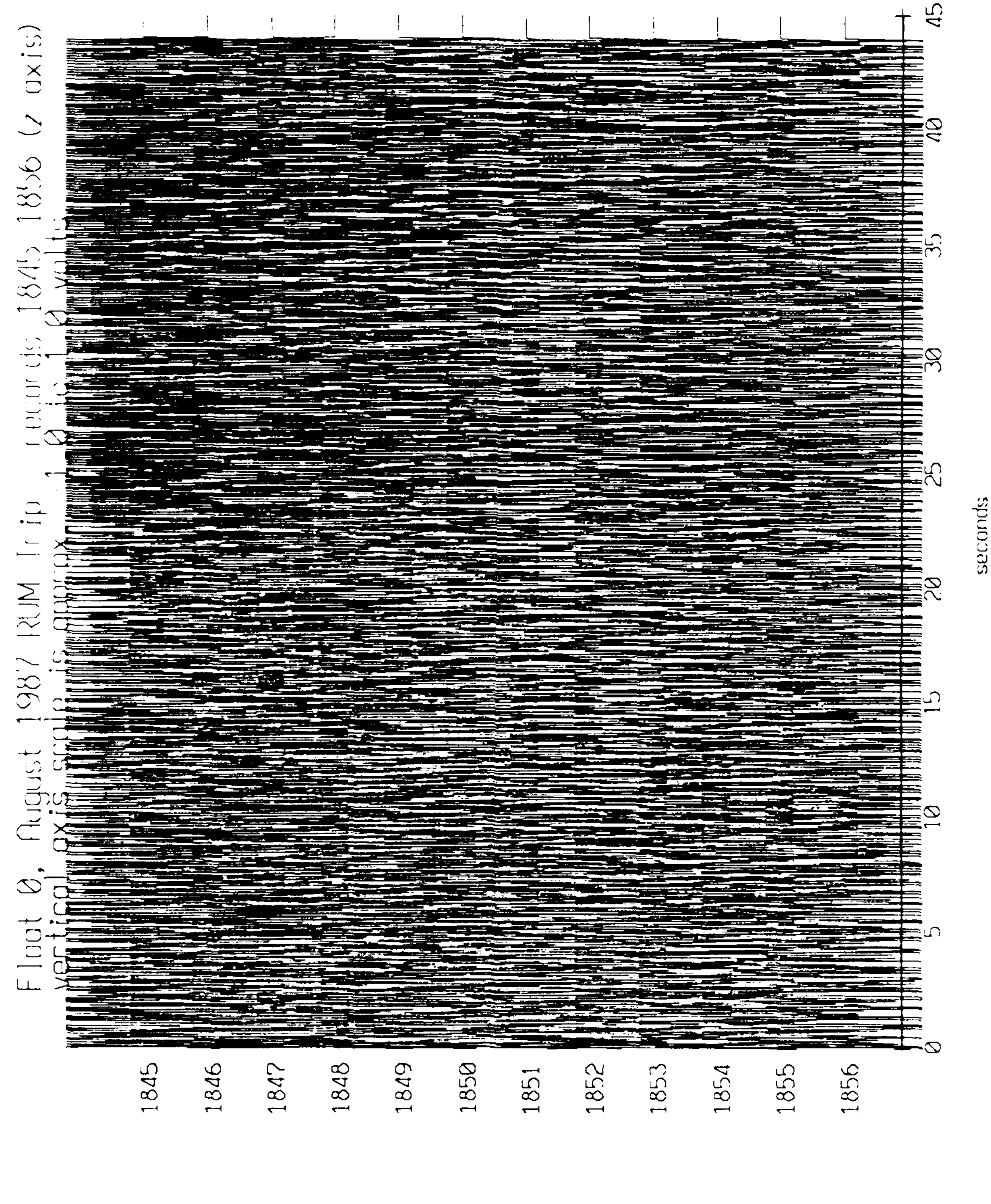

Float Ø, August 1987 RUM Trip records 1845 1856 (z axis)
seconds
0
5
10
15
20
25
30
35
40
45
1845
1846
1847
1848
1849
1850
1851
1852
1853
1854
1855
1856

Figure V.1c

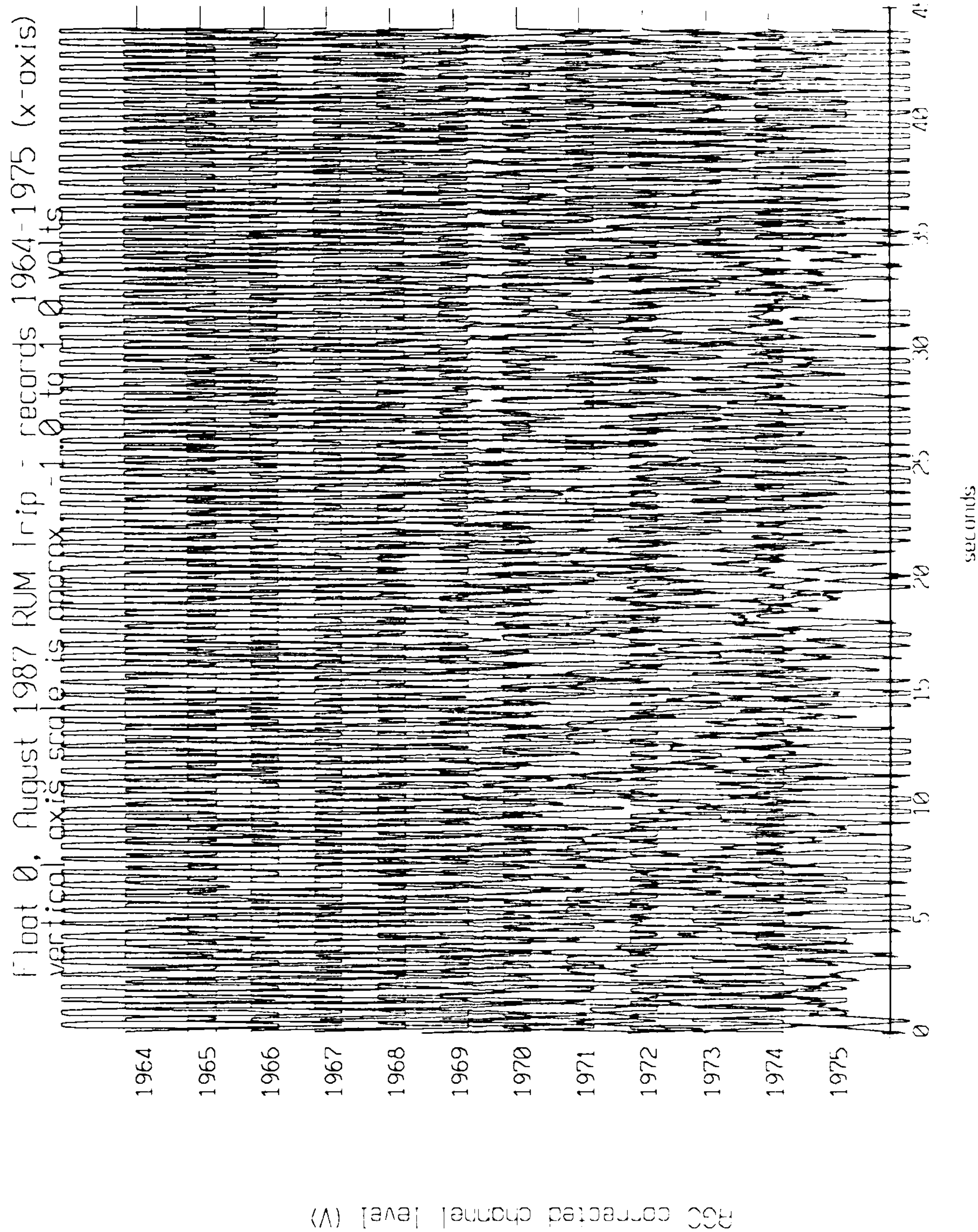
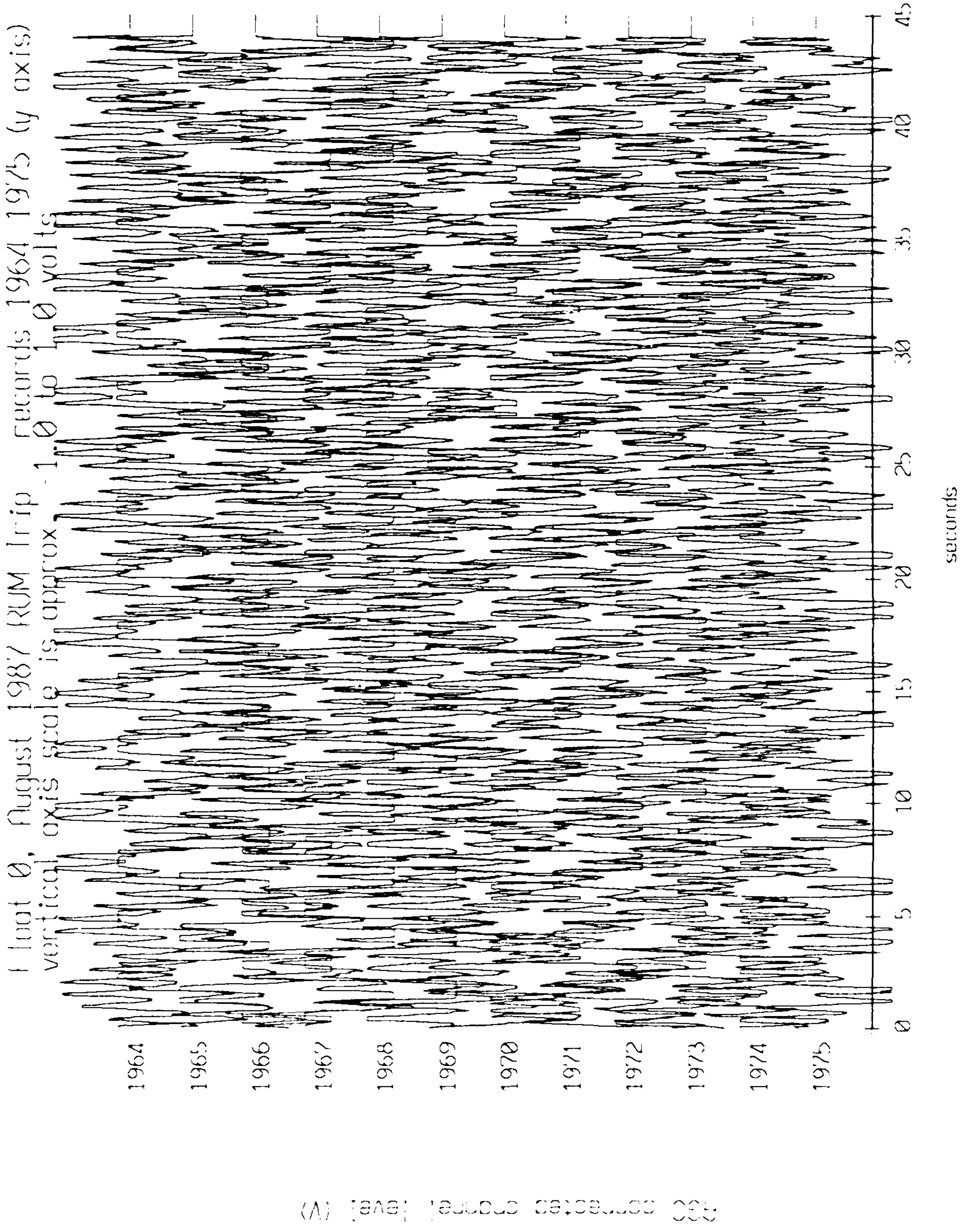
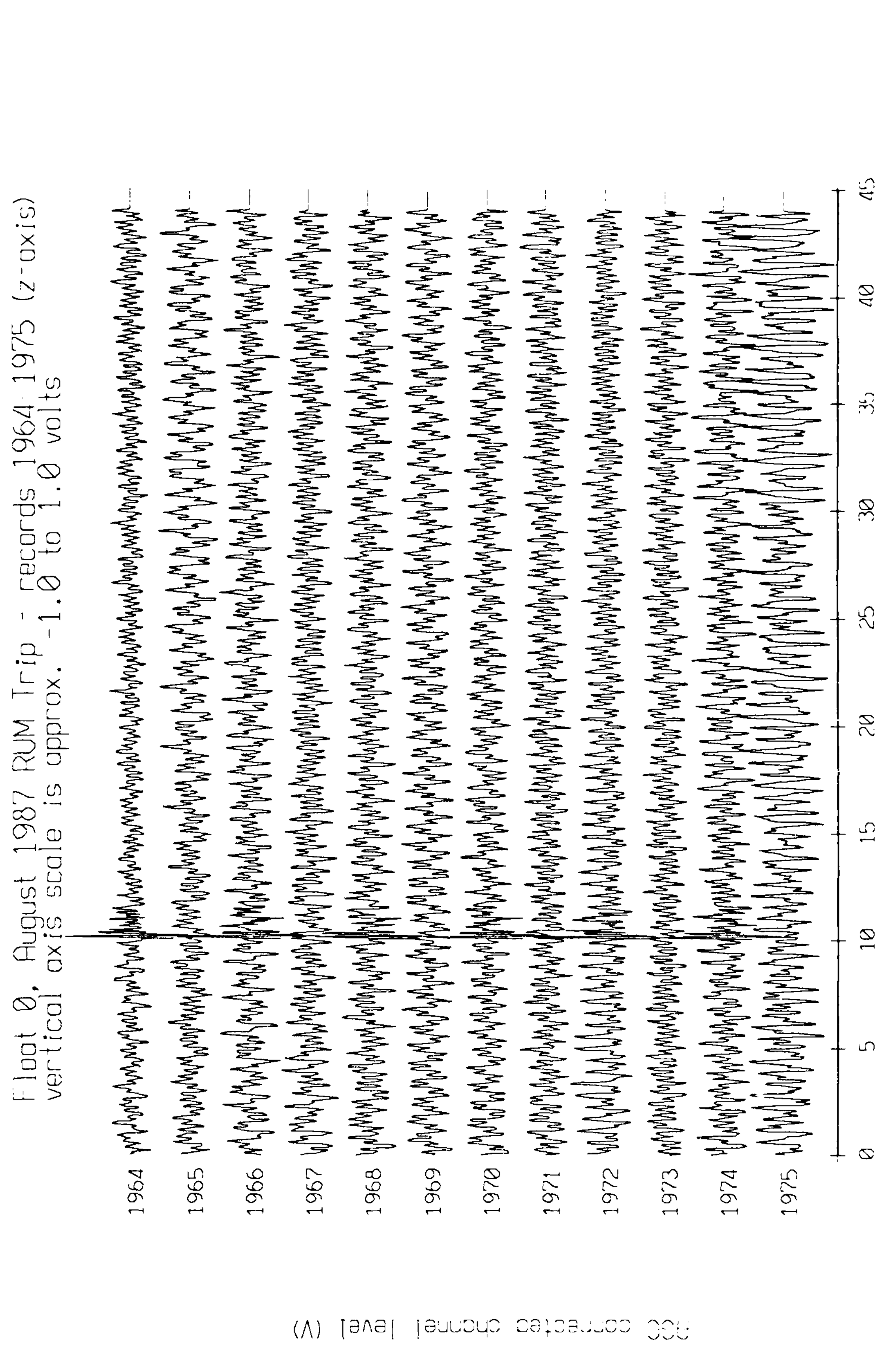

Float 0, August 1987 RUM Trip - records 1964-1975 (x-axis)
vertical axis scale is approx -1.0 to 1.0 volts
RGC corrected channel level (V)
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
0
5
10
15
20
25
30
35
40
45
seconds

Figure V.2a



Plot 0, August 1987 RUM Trip records 1964 1975 (y axis)
vertical axis scale is approx -1.0 to 1.0 volts
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
0
5
10
15
20
25
30
35
40
45
seconds
corrected channel level (V)

Figure V.2b



Float 0, August 1987 RUM Trip - records 1964-1975 (z-axis)
vertical axis scale is approx. -1.0 to 1.0 volts
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
0
5
10
15
20
25
30
35
40
45
seconds
ADC corrected channel level (V)

Figure V.2c

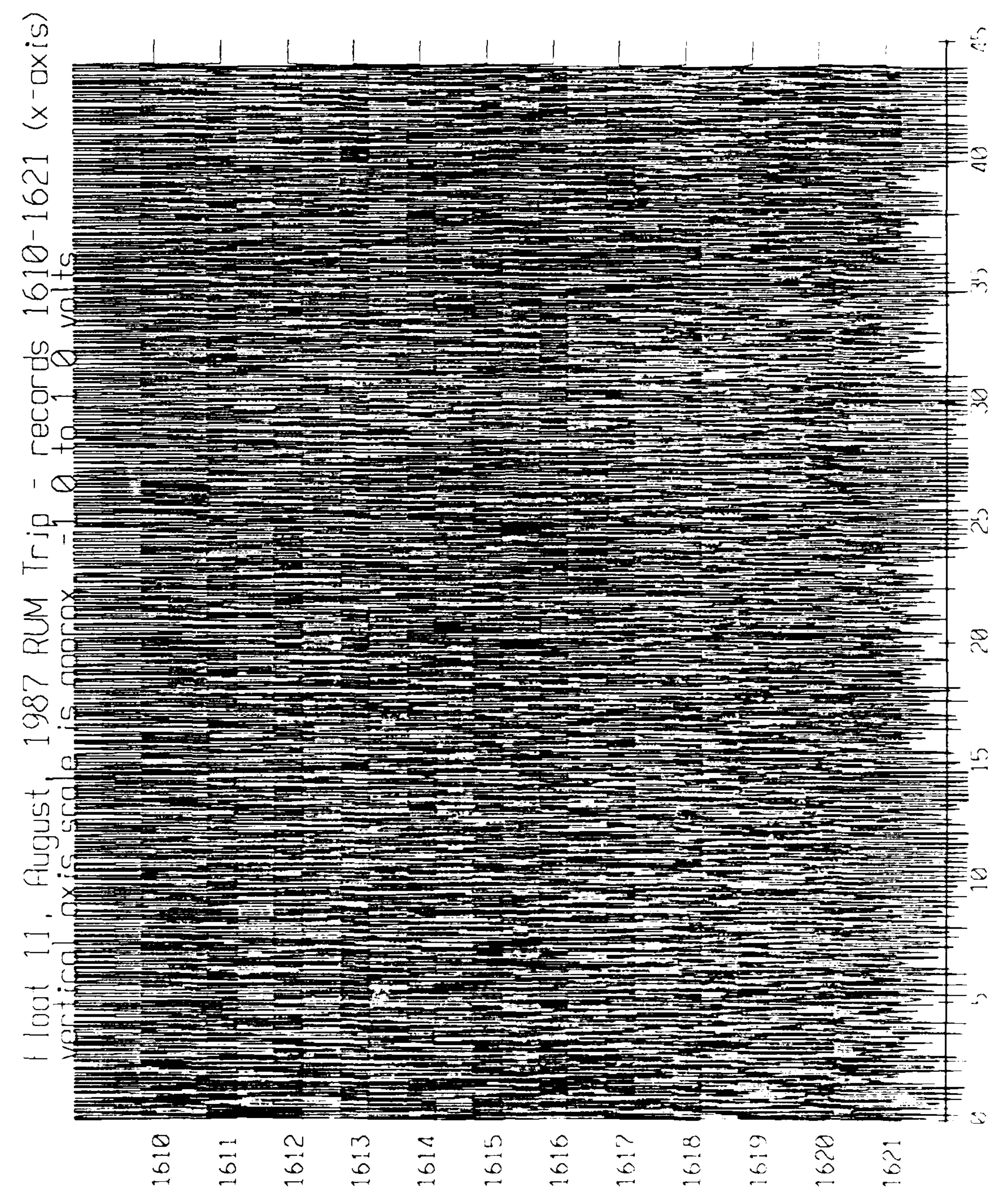
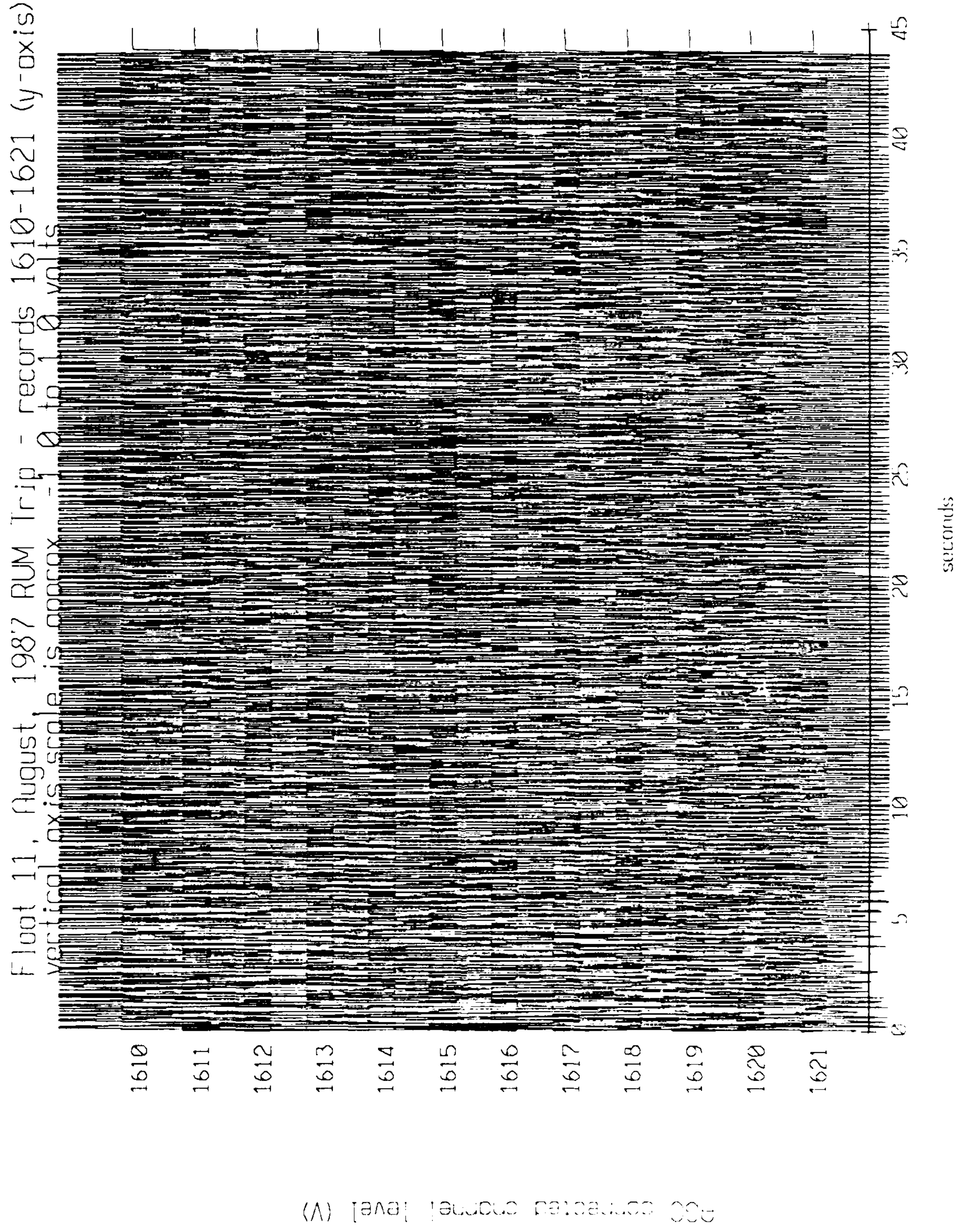
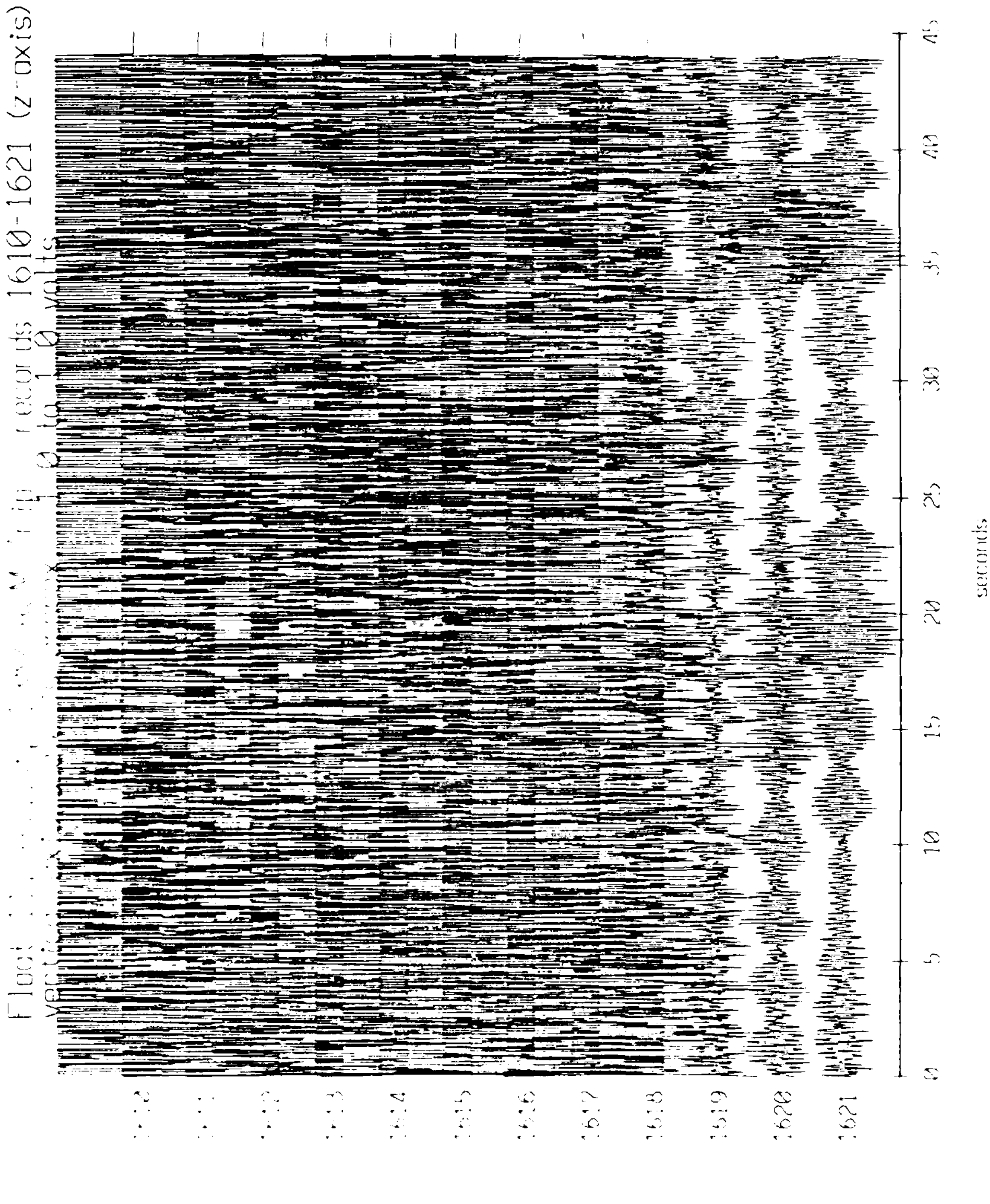

Float 11, August 1987 RUM Trip - records 1610-1621 (x-axis)
vertical axis scale is approx -1.0 to 1.0 volts
seconds
0
5
10
15
20
25
30
35
40
45
1610
1611
1612
1613
1614
1615
1616
1617
1618
1619
1620
1621

Figure V.3a



Float 11, August 1987 RUM Trip - records 1610-1621 (y-axis)
vertical axis scale is approx -1.0 to 1.0 volts
1610
1611
1612
1613
1614
1615
1616
1617
1618
1619
1620
1621
0
5
10
15
20
25
30
35
40
45
seconds

Figure V.3b



records 1610-1621 (z-axis)
0 to 1.0 volts
seconds
0
5
10
15
20
25
30
35
40
45
1614
1616
1617
1618
1619
1620
1621

Figure V.3e

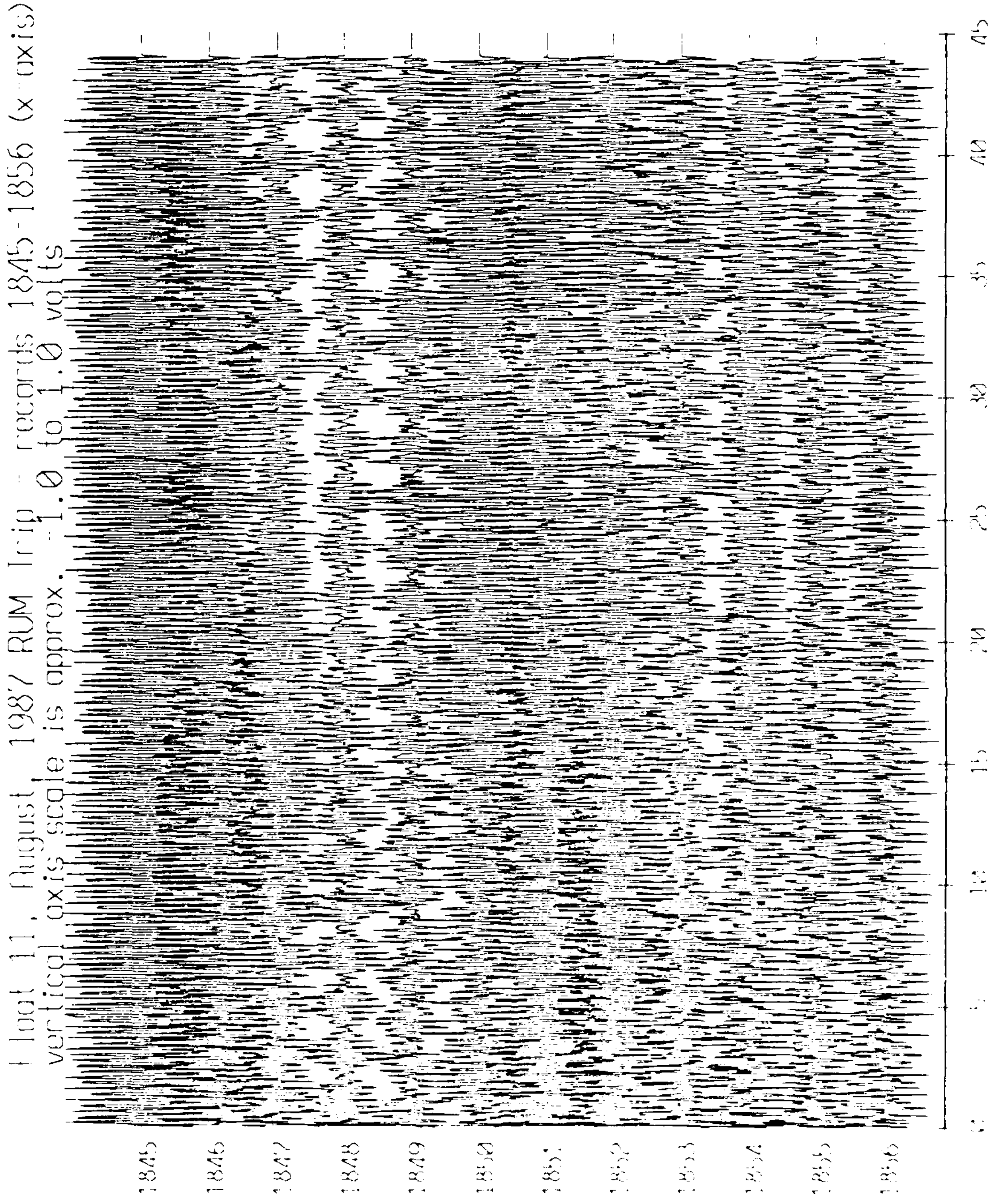

Float 11, August 1987 RUM Trip - records 1845-1856 (x-axis)
vertical axis scale is approx. -1.0 to 1.0 volts
seconds

Figure V 4a

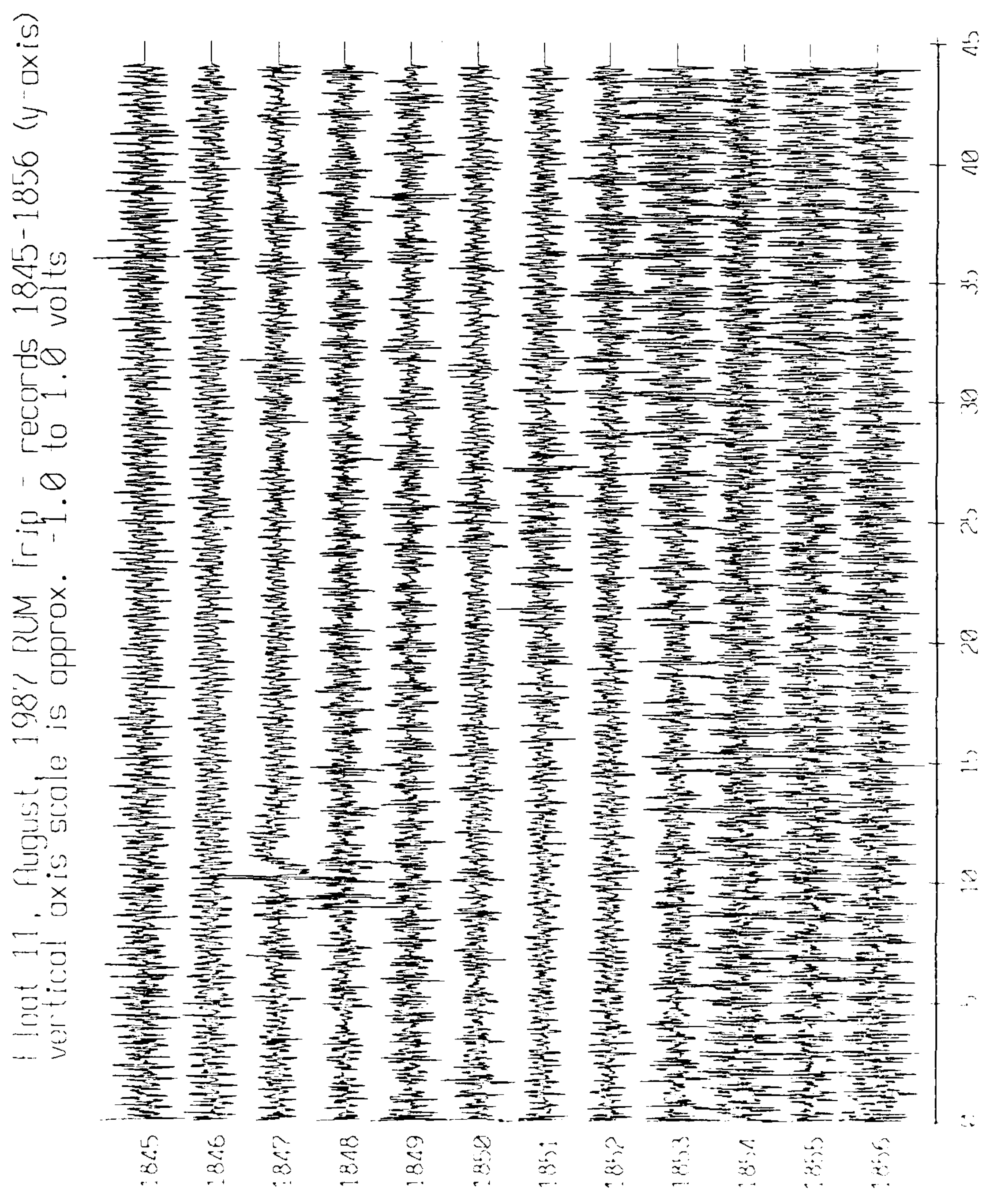

Float 11, August, 1987 RUM Trip - records 1845-1856 (y-axis)
vertical axis scale is approx. -1.0 to 1.0 volts
1845
1846
1847
1848
1849
1850
1851
1852
1853
1854
1855
1856
0
5
10
15
20
25
30
35
40
45
seconds

Figure V.4b

Float 11, August, 1987 RUM Trip - records 1845-1856 (z-axis)
vertical axis scale is approx. -1.0 to 1.0 volts

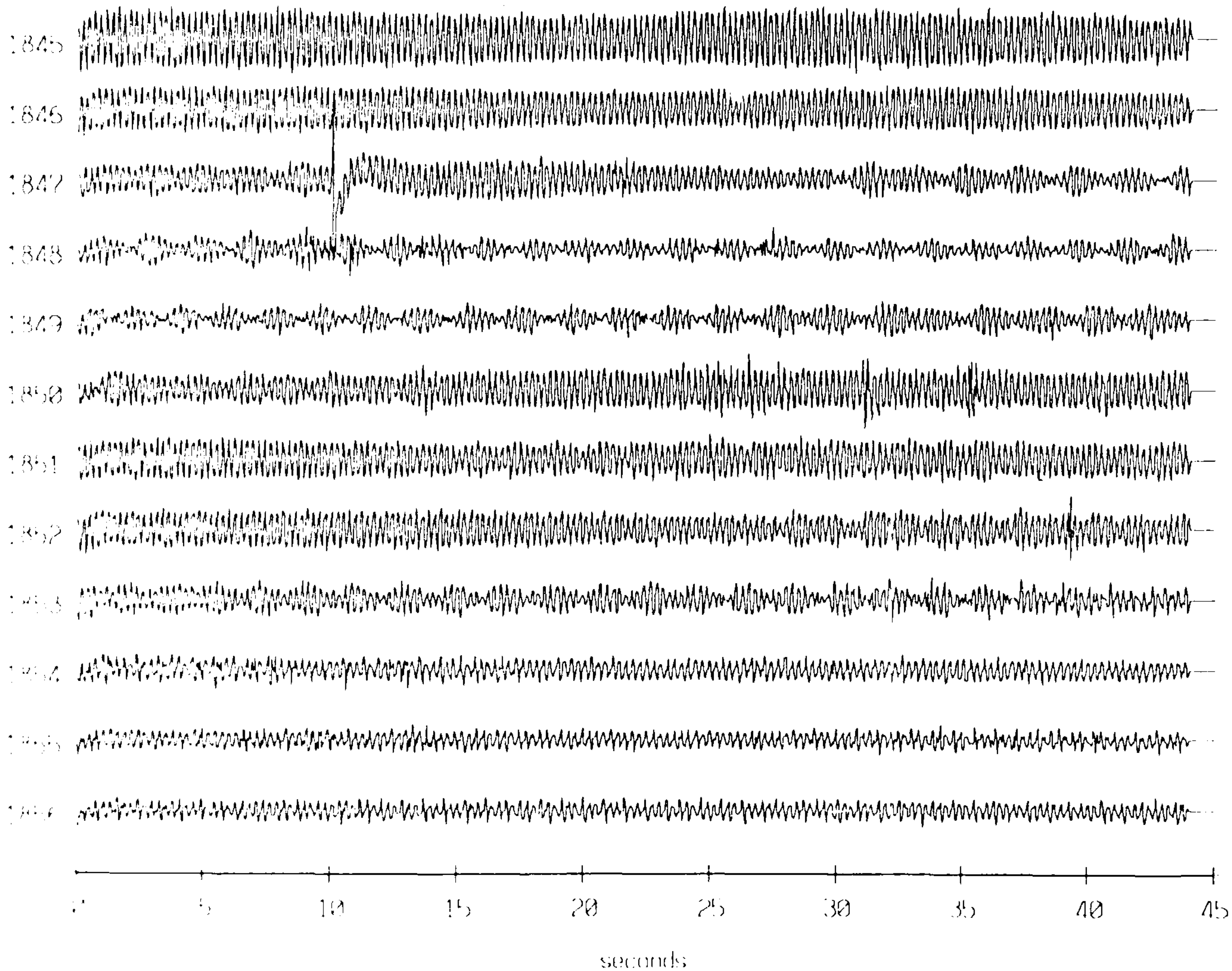


Figure V 4c

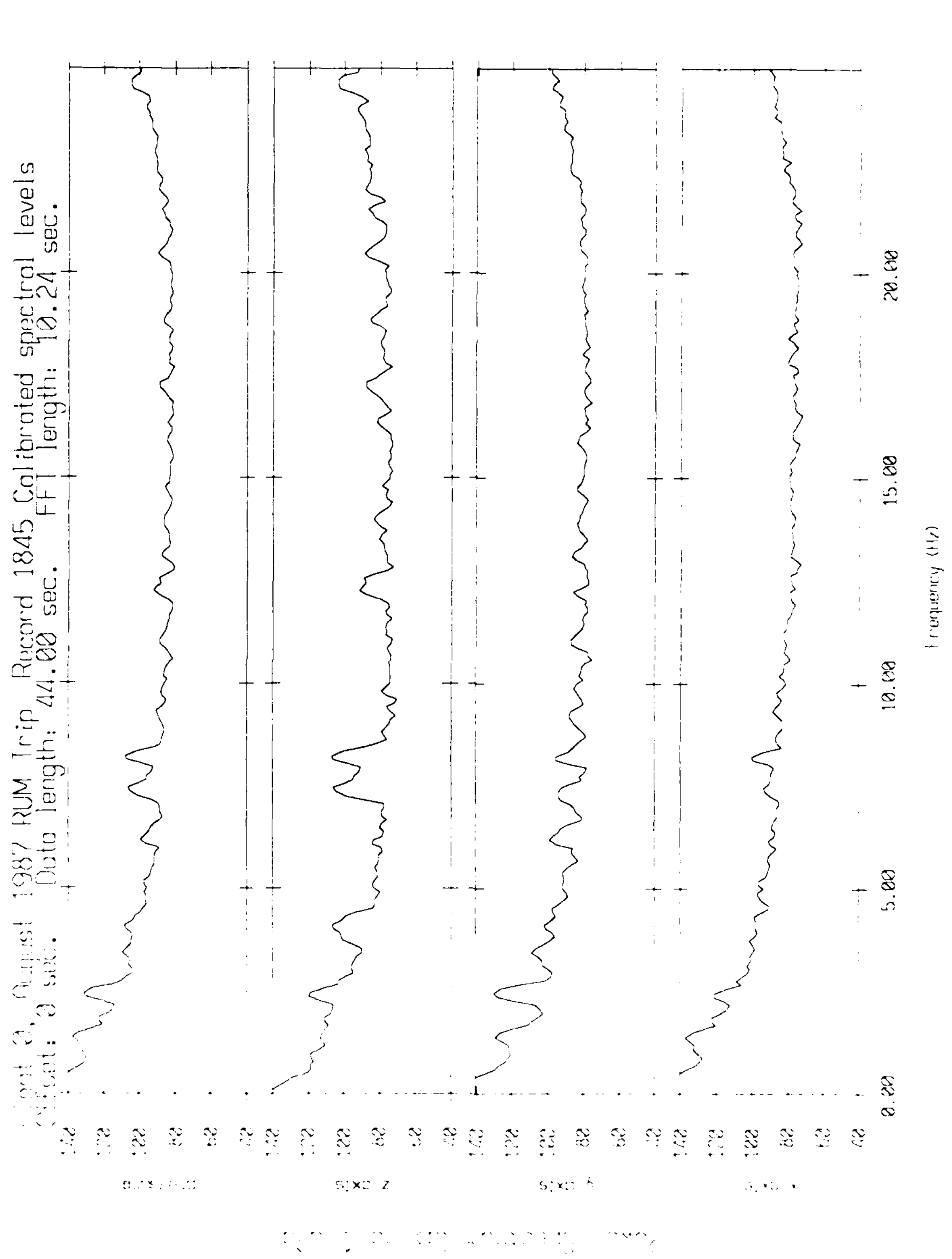

Unit 3, August 1987 RUM Trip, Record 1845 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI.1

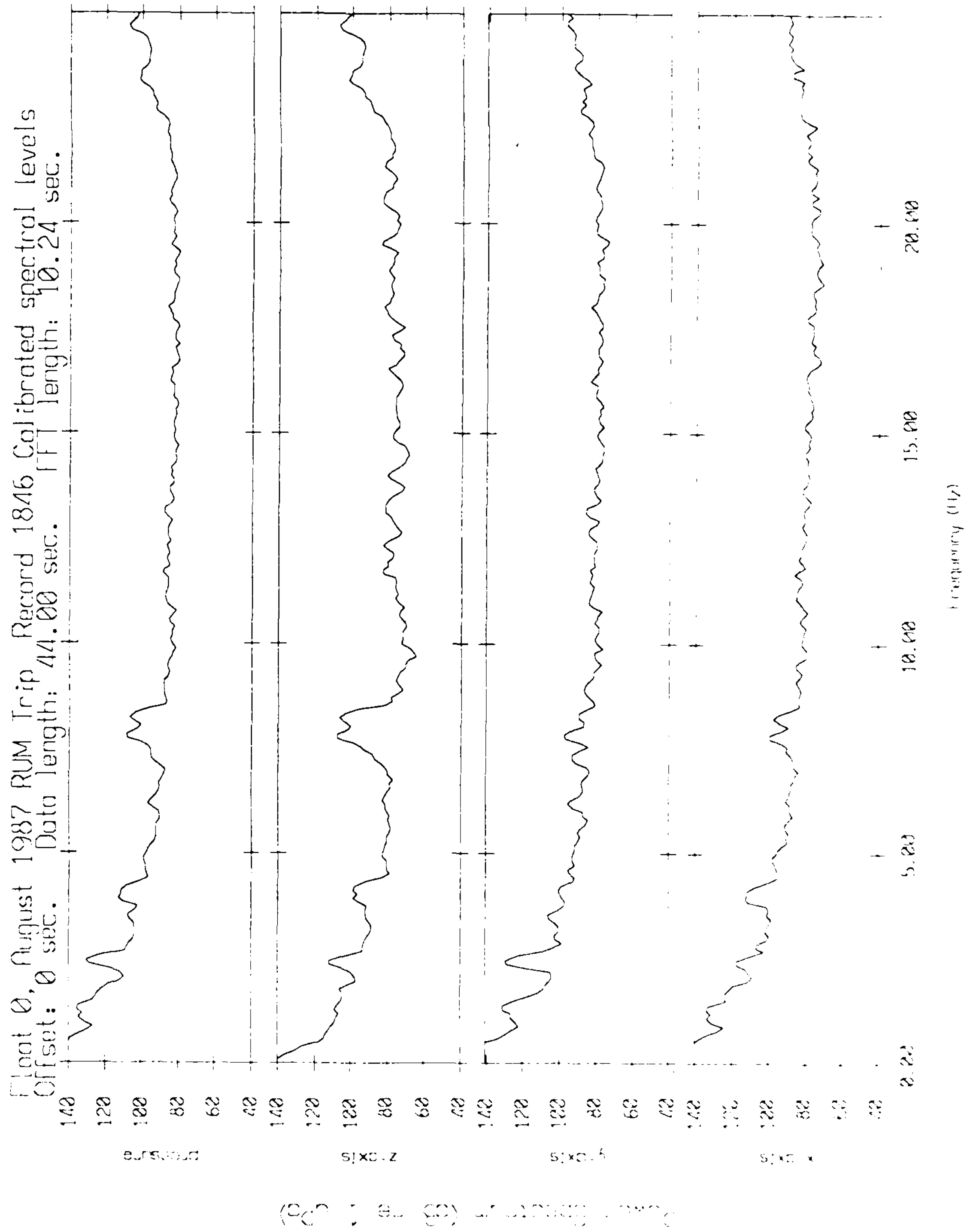

Float 0, August 1987 RUM Trip, Record 1846 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
140
120
100
80
60
40
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI-2

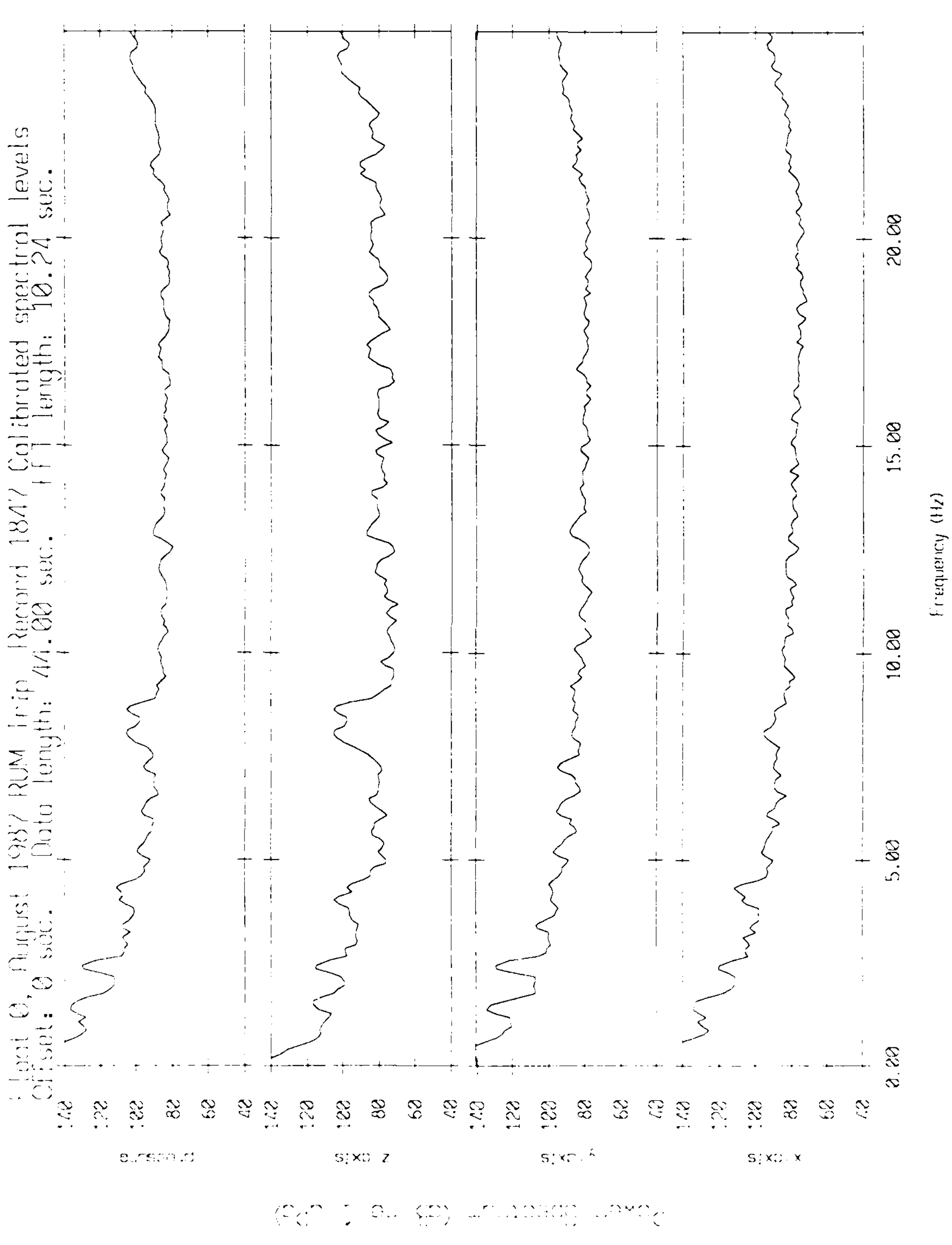
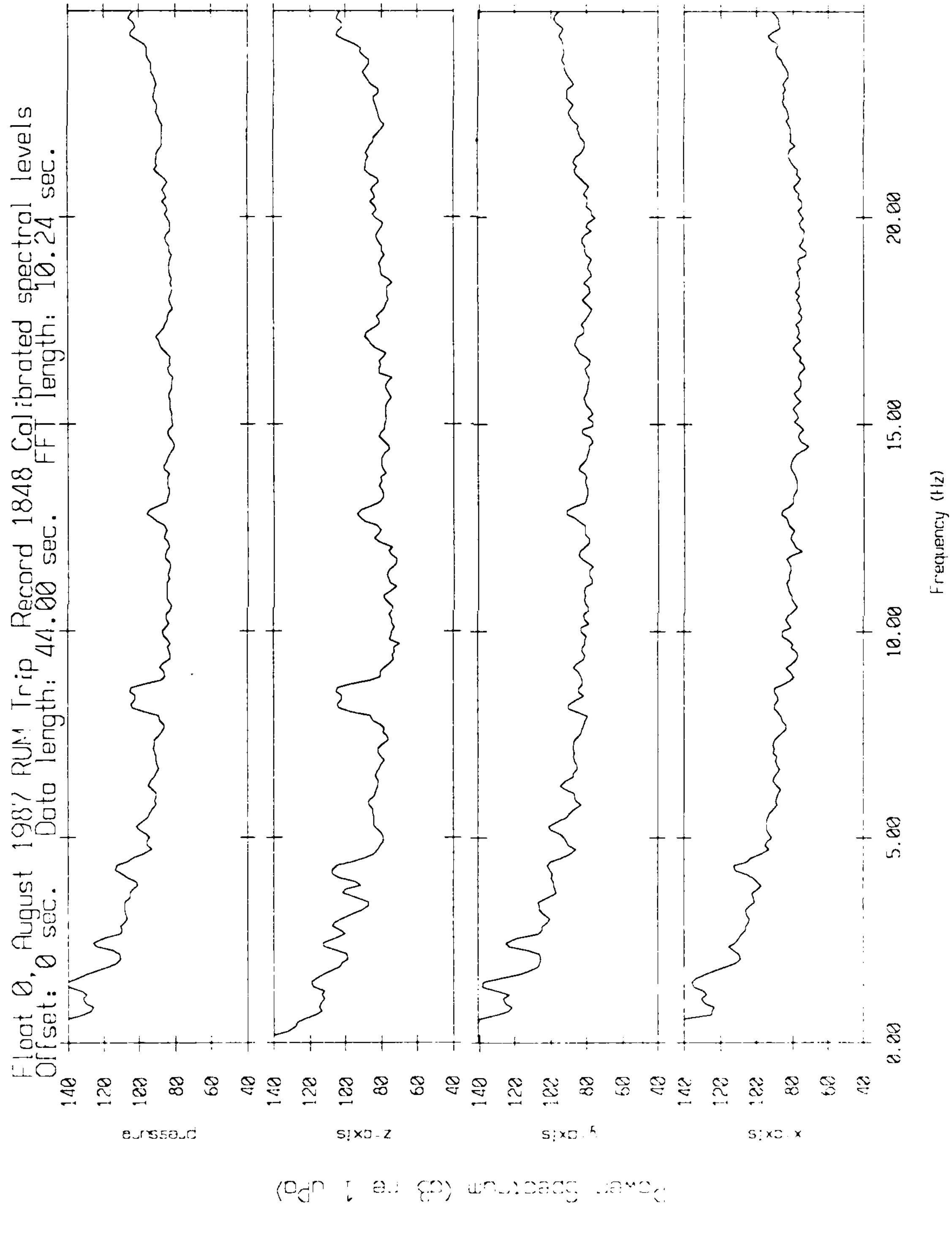
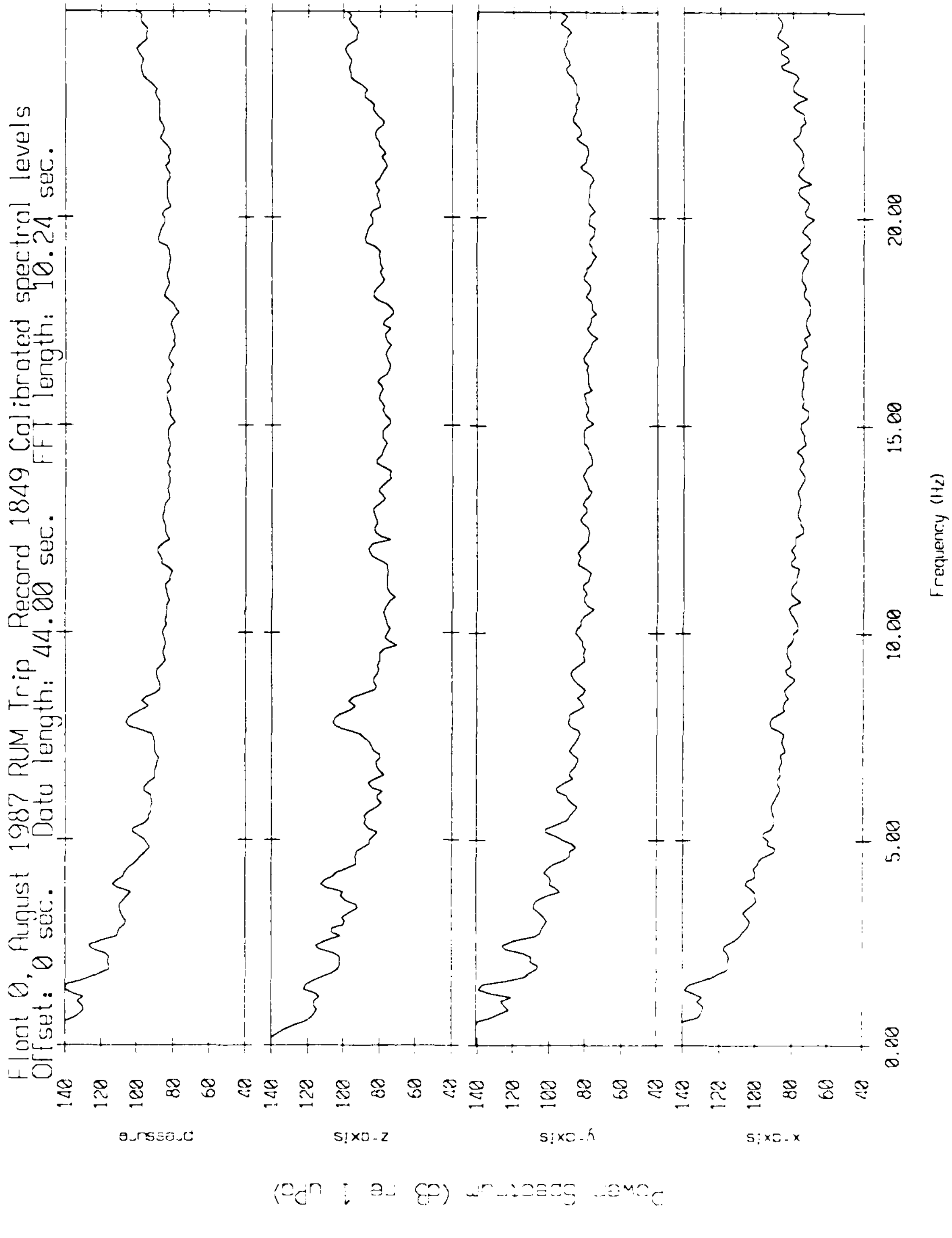

Float 0, August 1987 RUM Trip Record 1847 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z axis
y axis
x axis
140
120
100
80
60
40
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI.3



Float 0, August 1987 RUM Trip Record 1848 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
140
120
100
80
60
40
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI.4



Float 0, August 1987 RUM Trip Record 1849 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
Power Spectrum (dB re 1 uPa)
140
120
100
80
60
40
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI.5

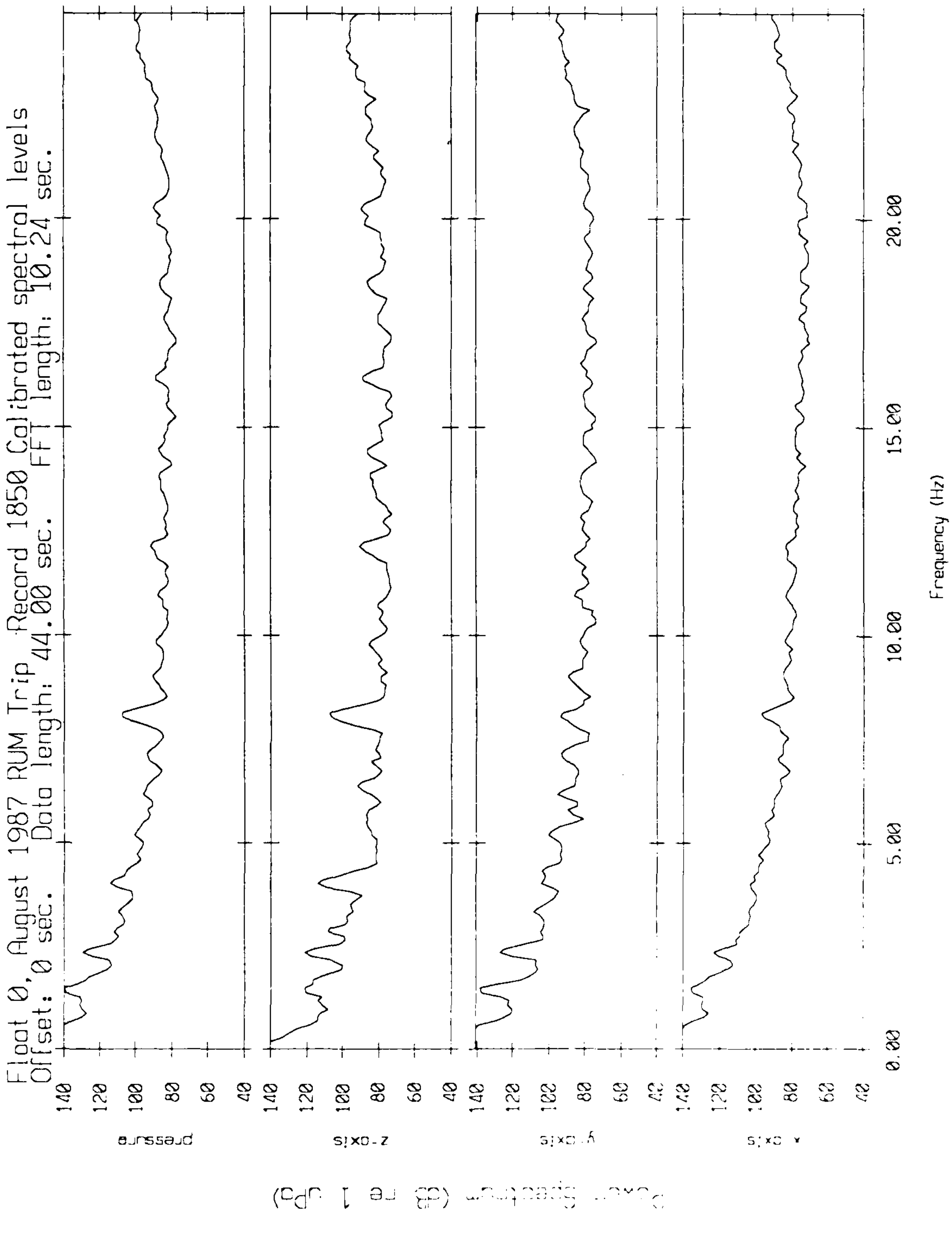

Float 0, August 1987 RUM Trip Record 1850 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
Frequency (Hz)

Figure VI.6

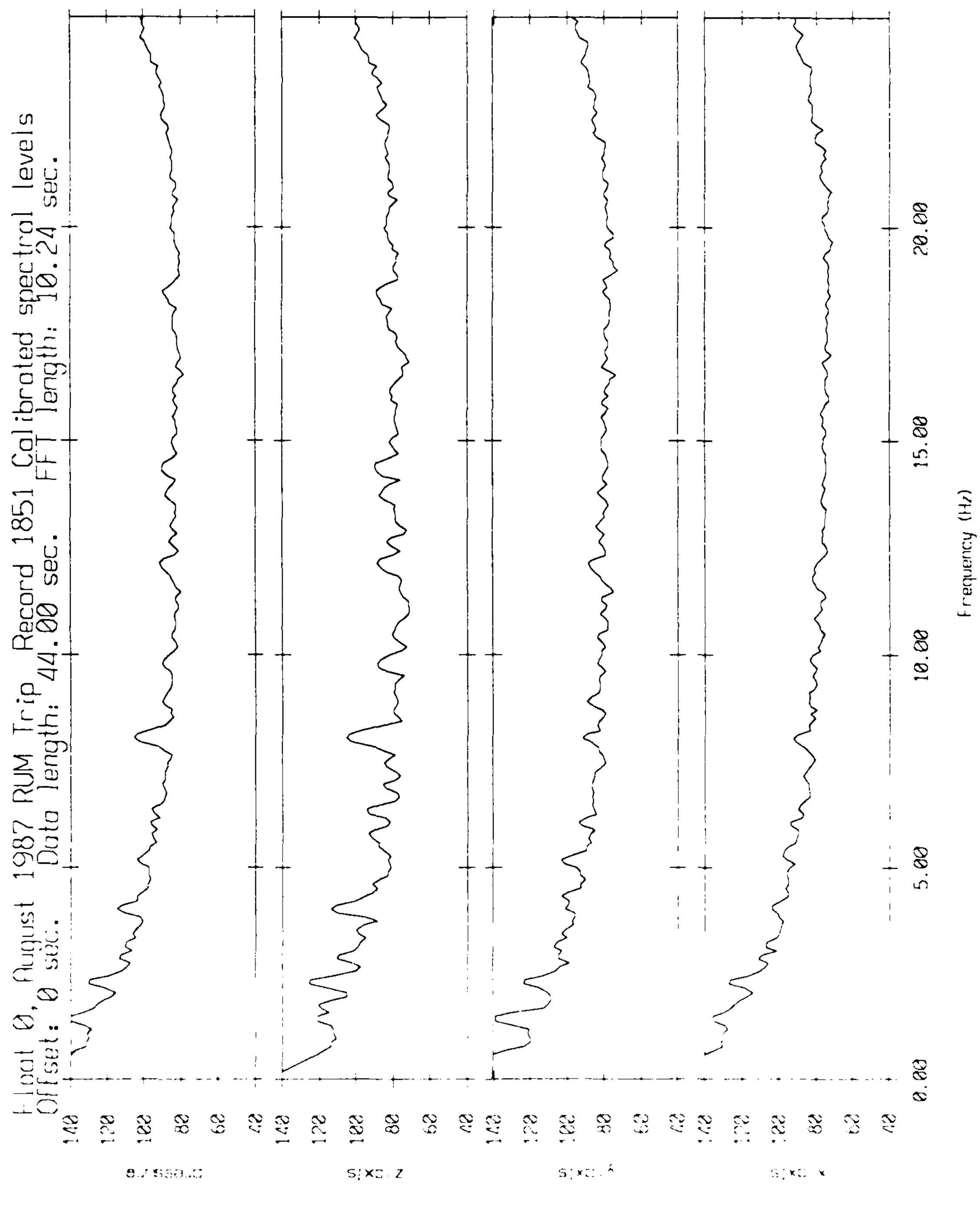

Float 0, August 1987 RUM Trip Record 1851 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z axis
y axis
x axis
140
120
100
80
60
40
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI.7

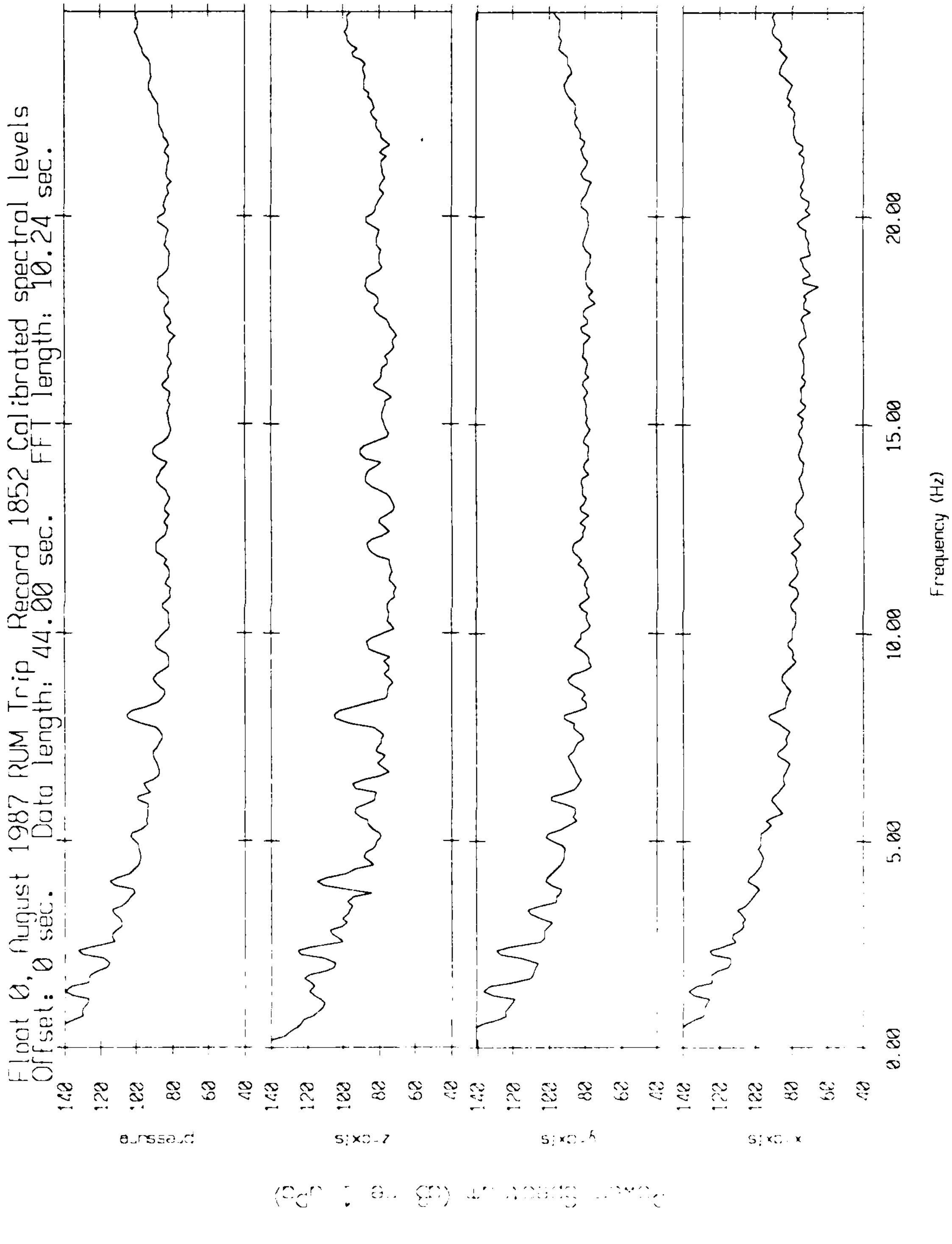
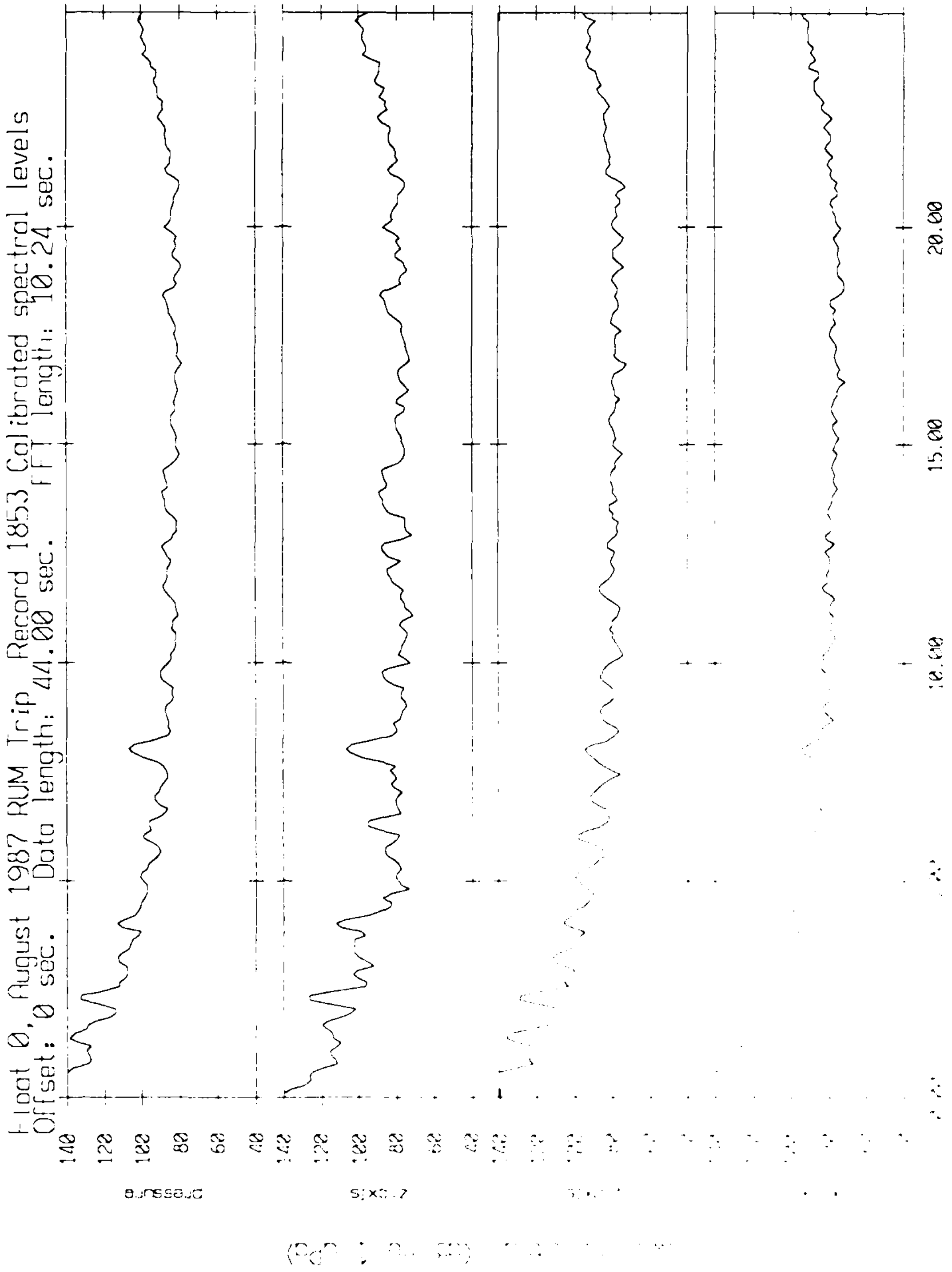
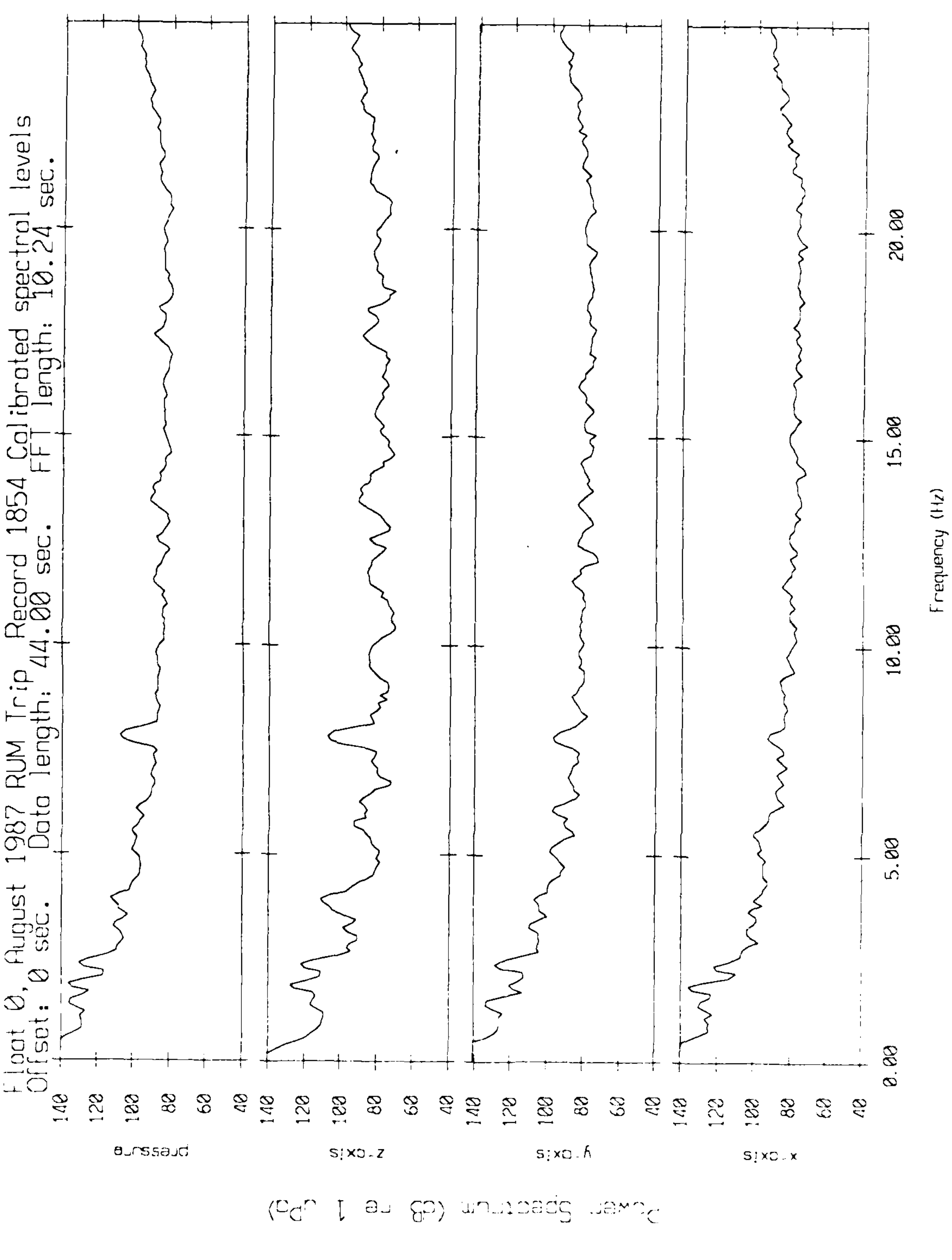

Float 0, August 1987 RUM Trip, Record 1852 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
Power Spectrum (dB re 1 µPa)
140
120
100
80
60
40
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI.8



Float 0, August 1987 RUM Trip, Record 1853 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
140
120
100
80
60
40
pressure
Frequency (Hz)
10.00
15.00
20.00

Figure VI.9



Float 0, August 1987 RUM Trip Record 1854 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
Power Spectrum (dB re 1 uPa)
Frequency (Hz)
0.00
5.00
10.00
15.00
20.00
140
120
100
80
60
40

Figure VI.10

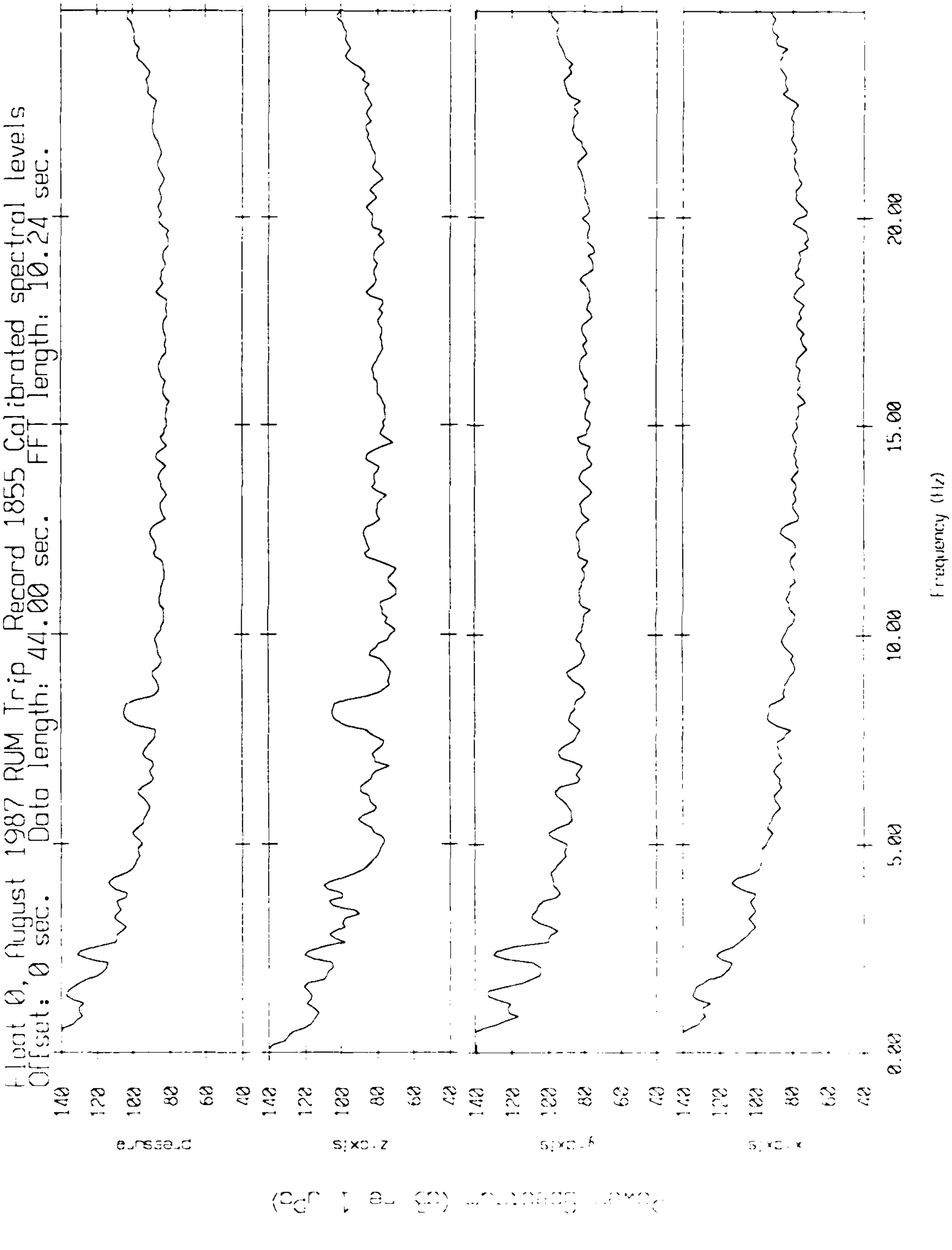

Float 0, August 1987 RUM Trip Record 1855 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
140
120
100
80
60
40
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI.11

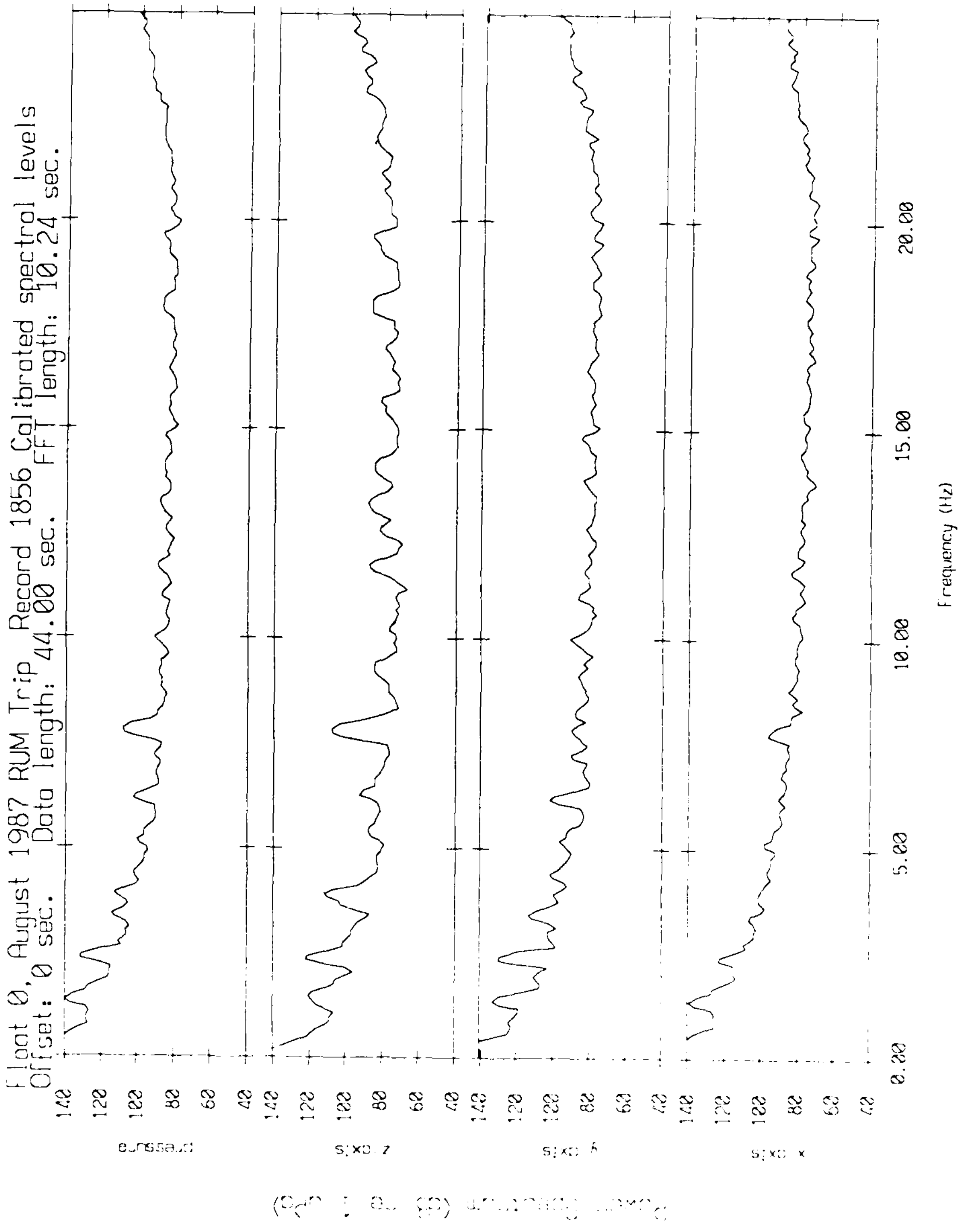

Float 0, August 1987 RUM Trip Record 1856 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
140
120
100
80
60
40
pressure
z axis
y axis
x axis
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI.12

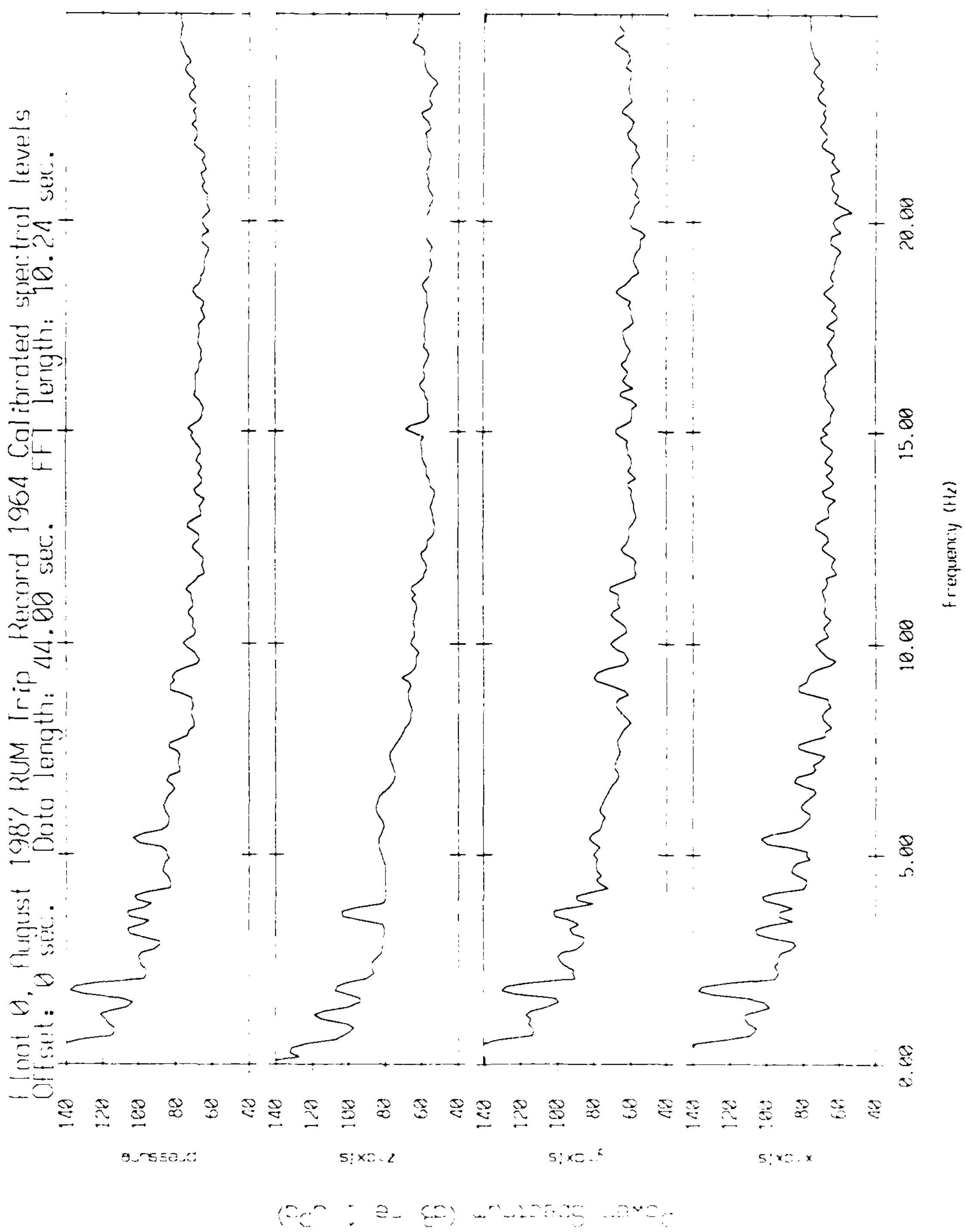
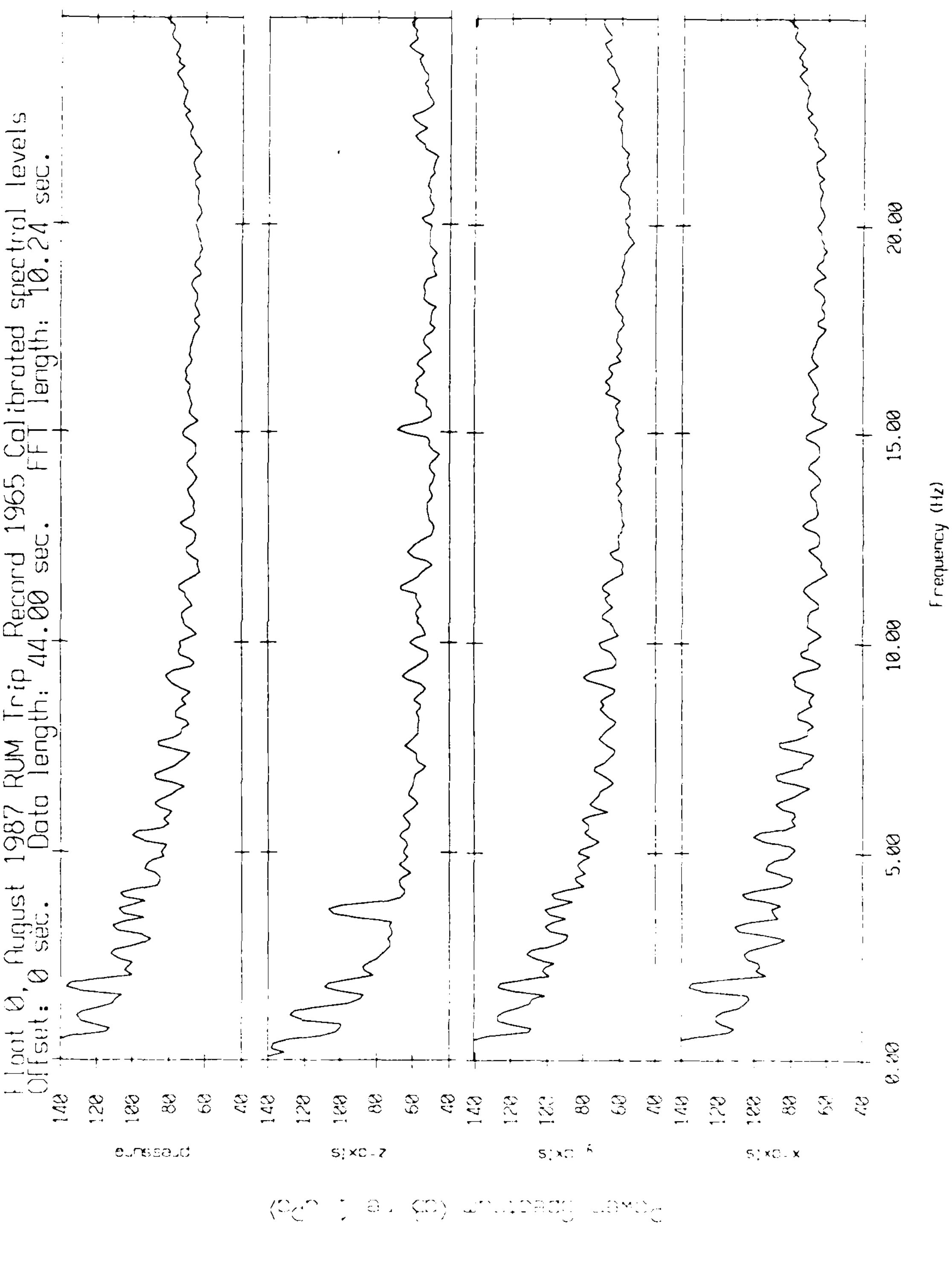

Float 0, August 1987 RUM Trip Record 1964 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
140
120
100
80
60
40
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI.13



Float 0, August 1987 RUM Trip, Record 1965 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
140
120
100
80
60
40
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI.14

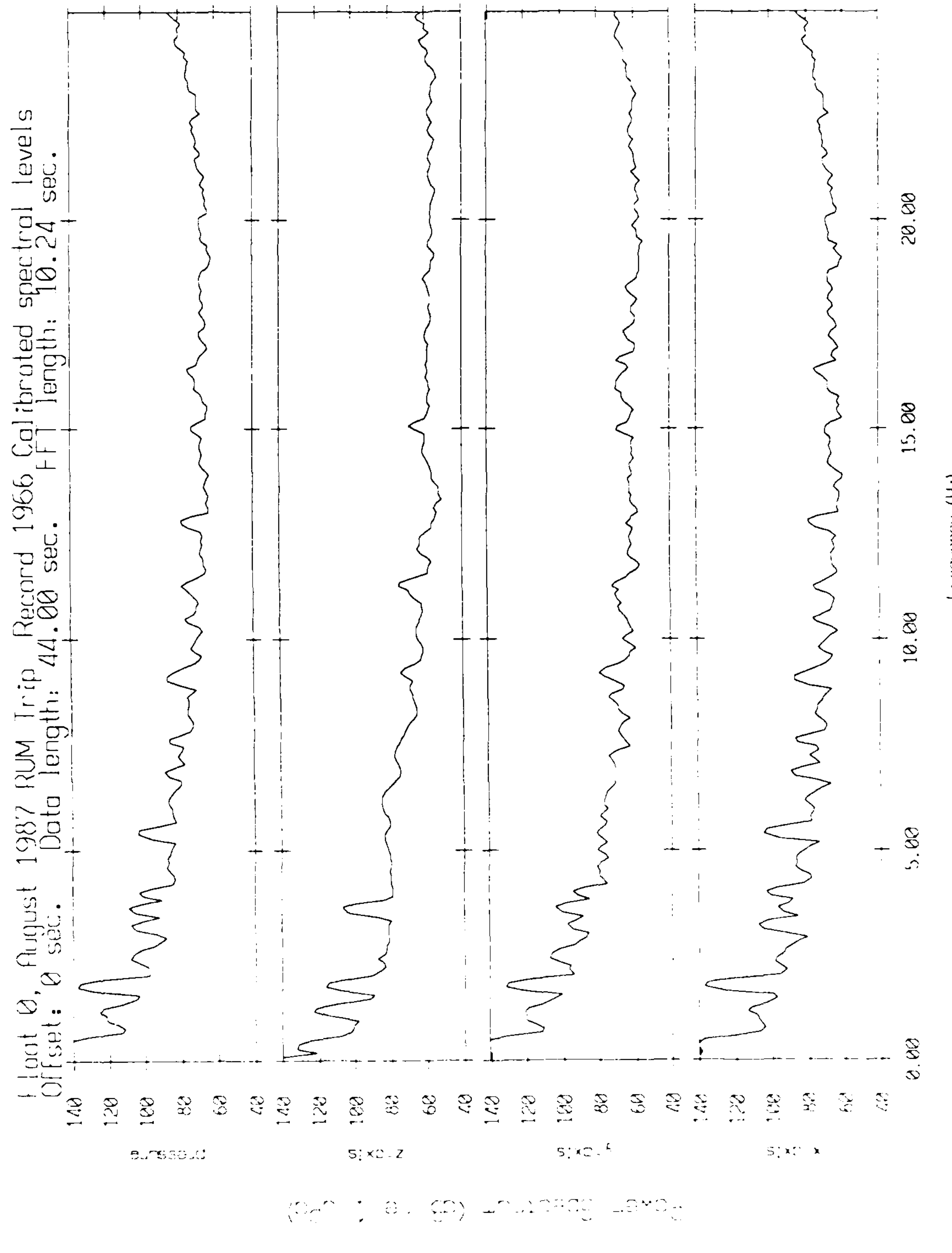

Float 0, August 1987 RUM Trip, Record 1966 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
x-axis
140
120
100
80
60
40
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI.15

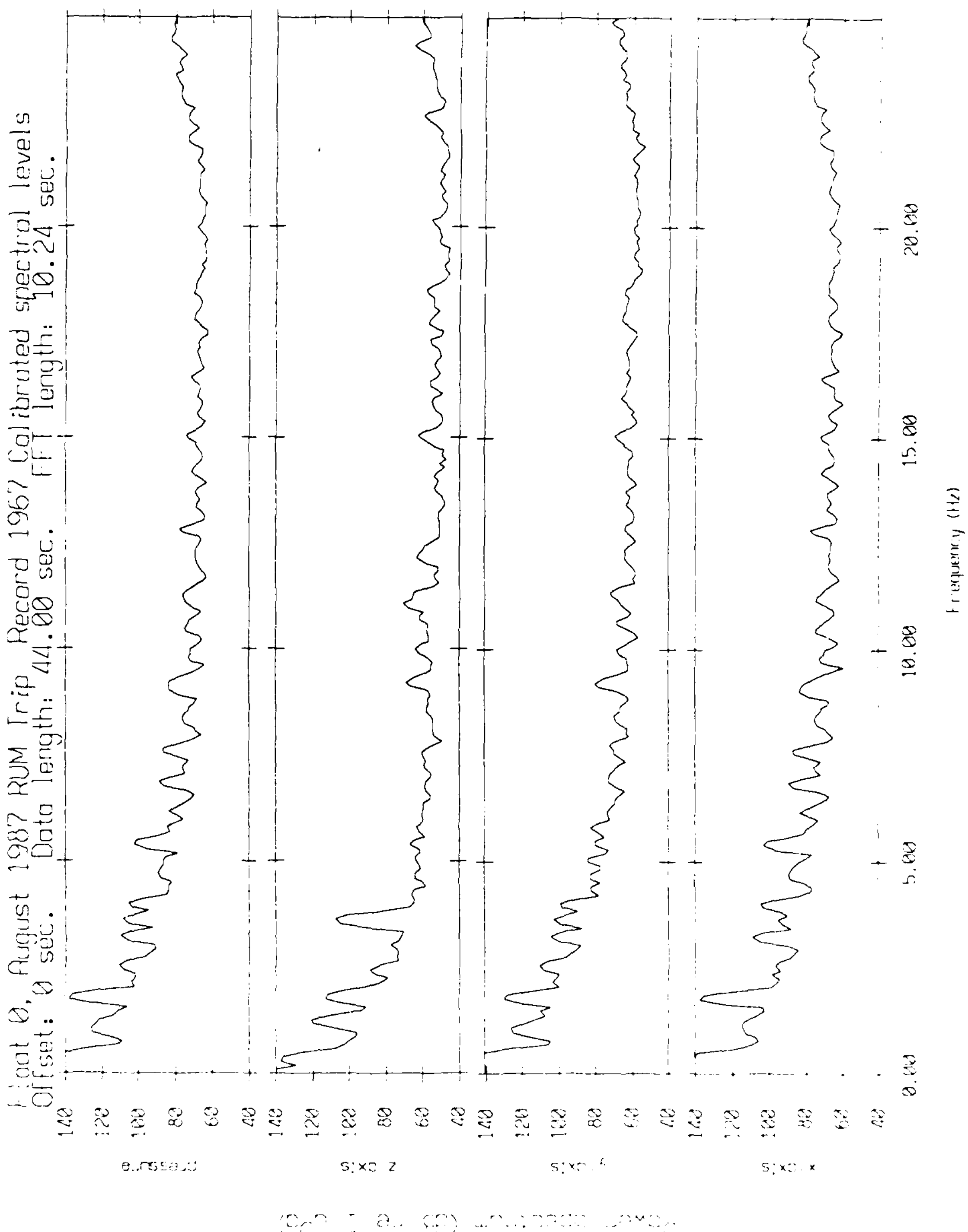
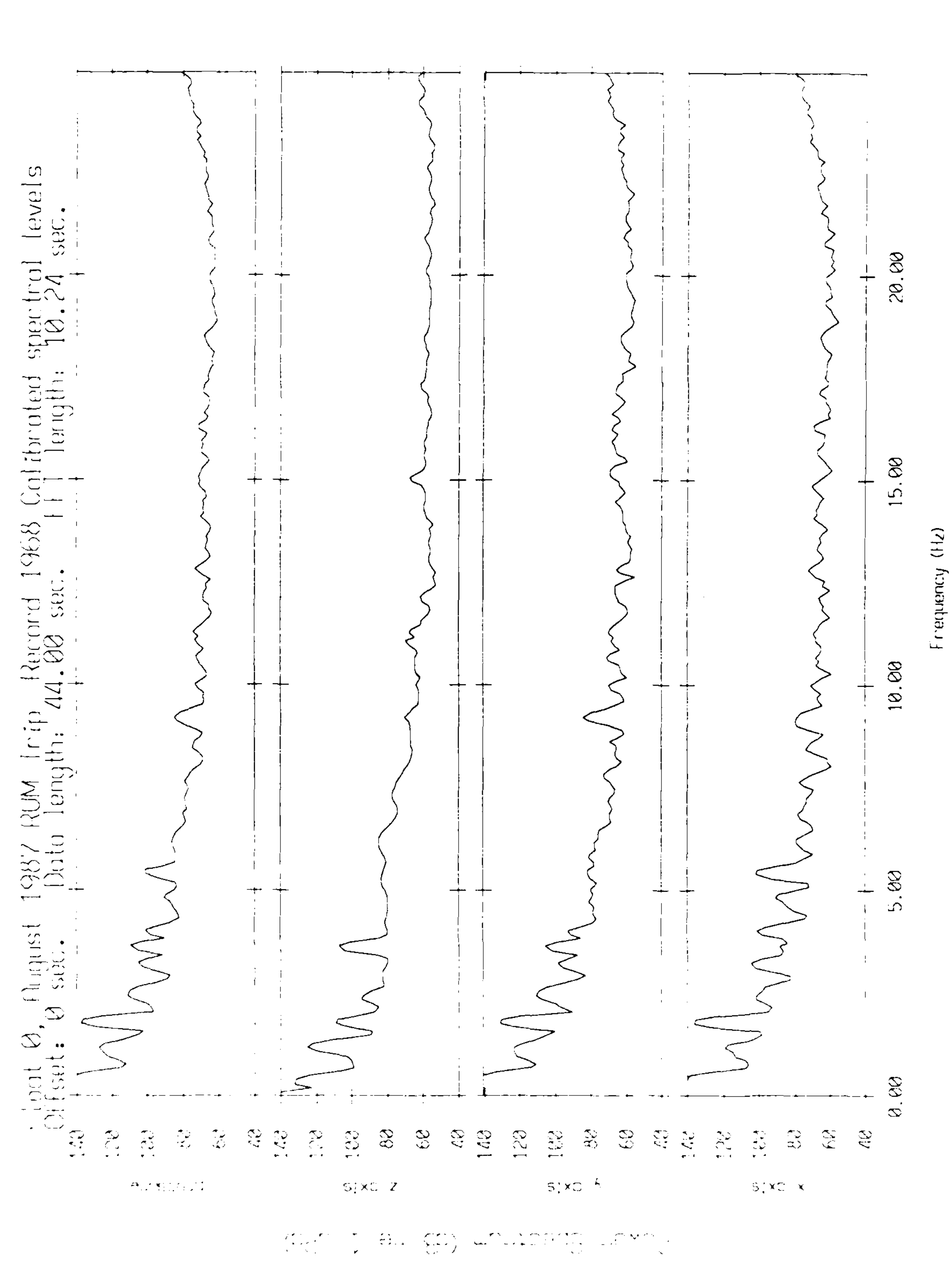
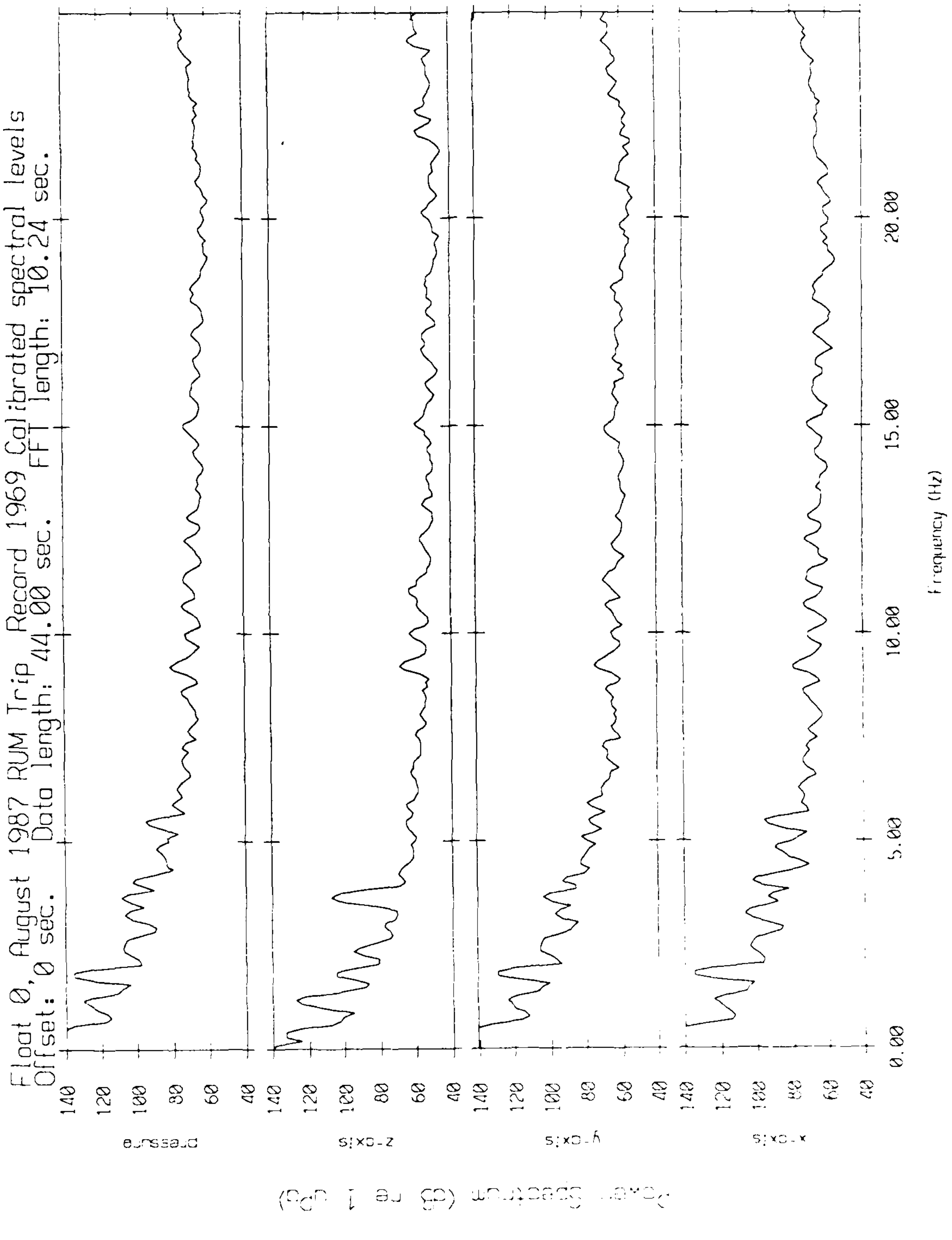

Float 0, August 1987 RUM Trip, Record 1967 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z axis
y axis
x axis
Frequency (Hz)

Figure VI.16



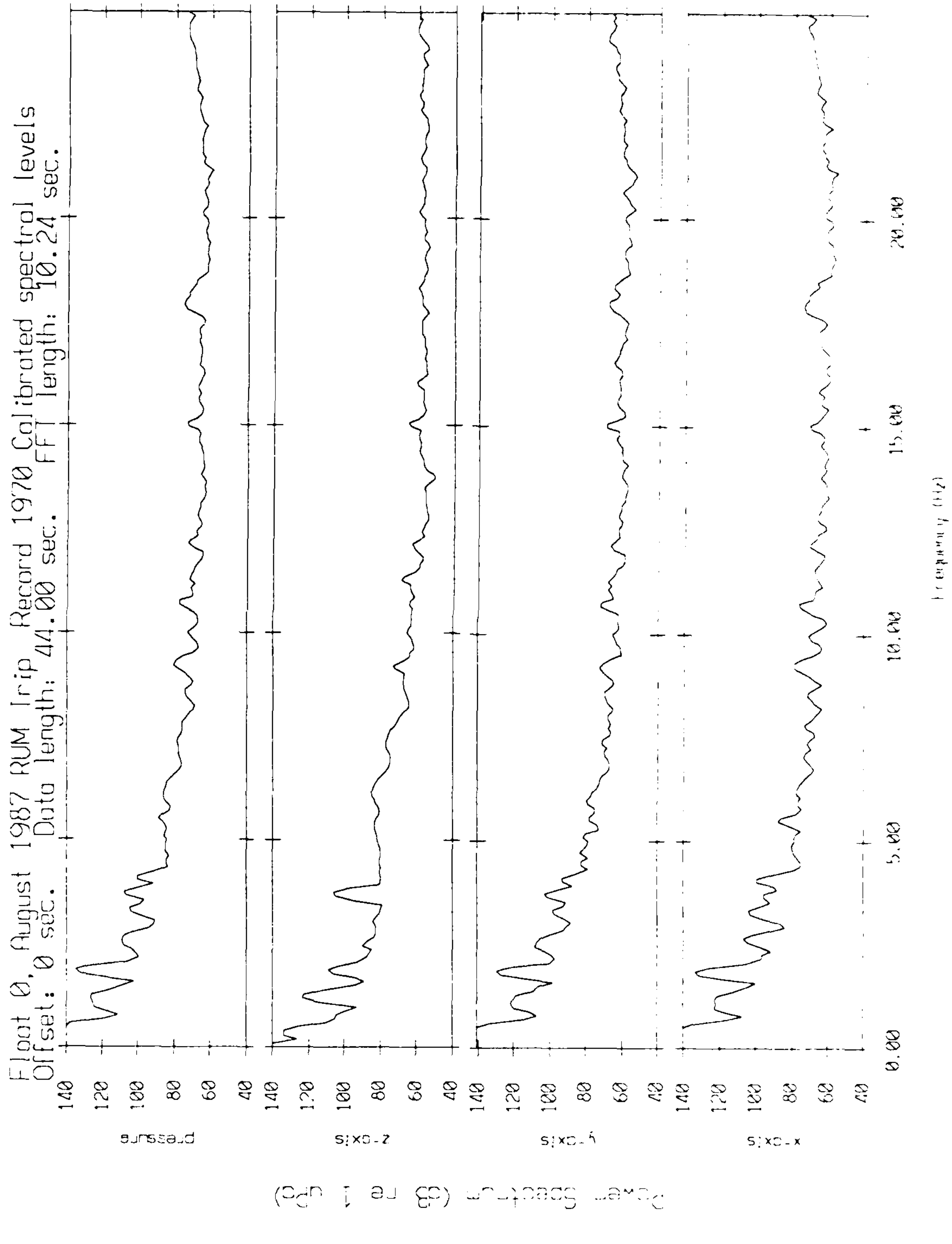
Shot 0, August 1987 RUM Trip, Record 1968 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI.17



Float 0, August 1987 RUM Trip Record 1969 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
Power Spectrum (dB re 1 uPa)
Frequency (Hz)
140
120
100
80
60
40
0.00
5.00
10.00
15.00
20.00

Figure VI.18



Float 0, August 1987 RUM Trip Record 1970 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
Power Spectrum (dB re 1 uPa)
0.00
5.00
10.00
15.00
20.00

Figure VI.19

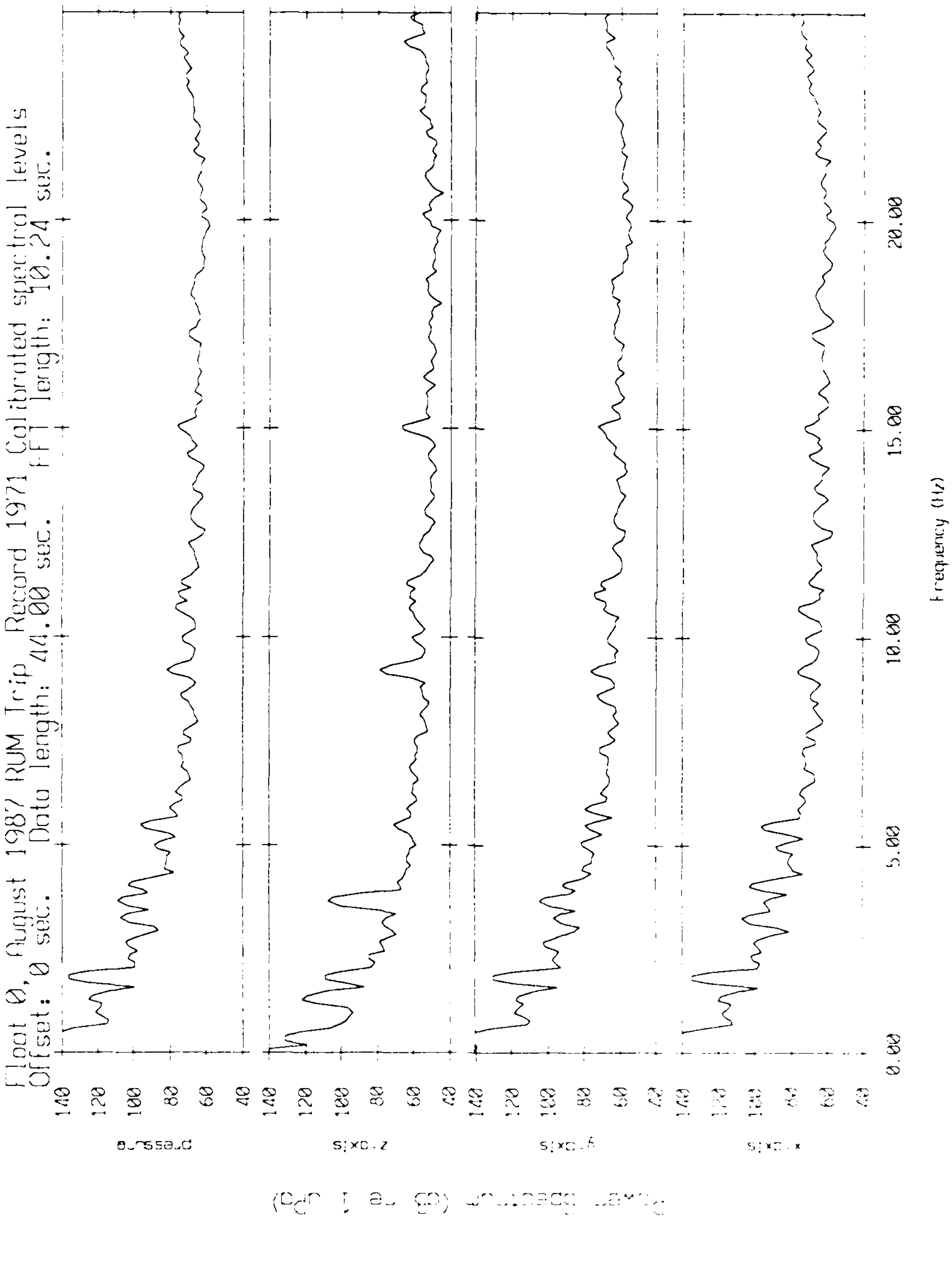

Float 0, August 1987 RUM Trip, Record 1971 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
140
120
100
80
60
40
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI.20

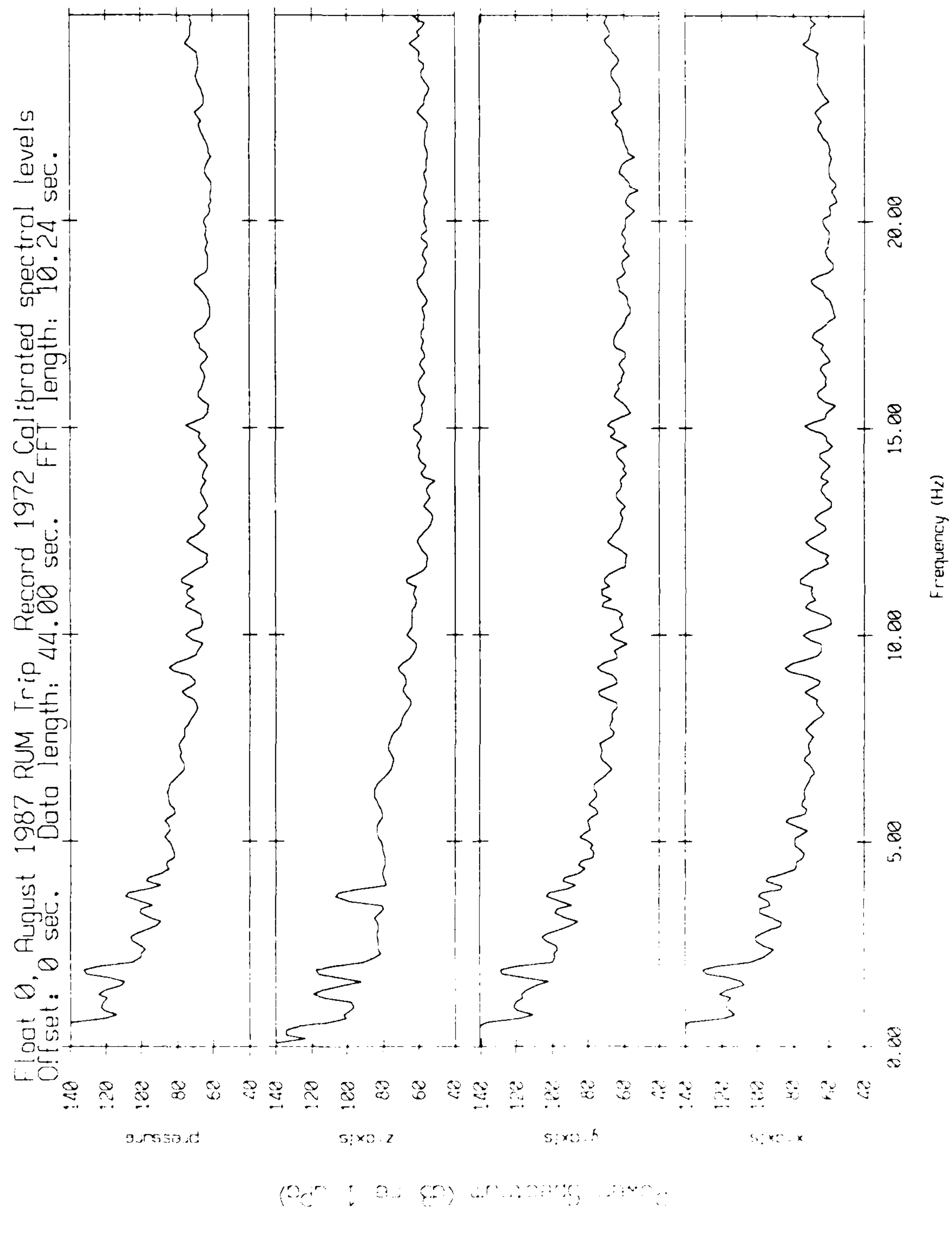

Float 0, August 1987 RUM Trip, Record 1972 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
140
120
100
80
60
40
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI.21

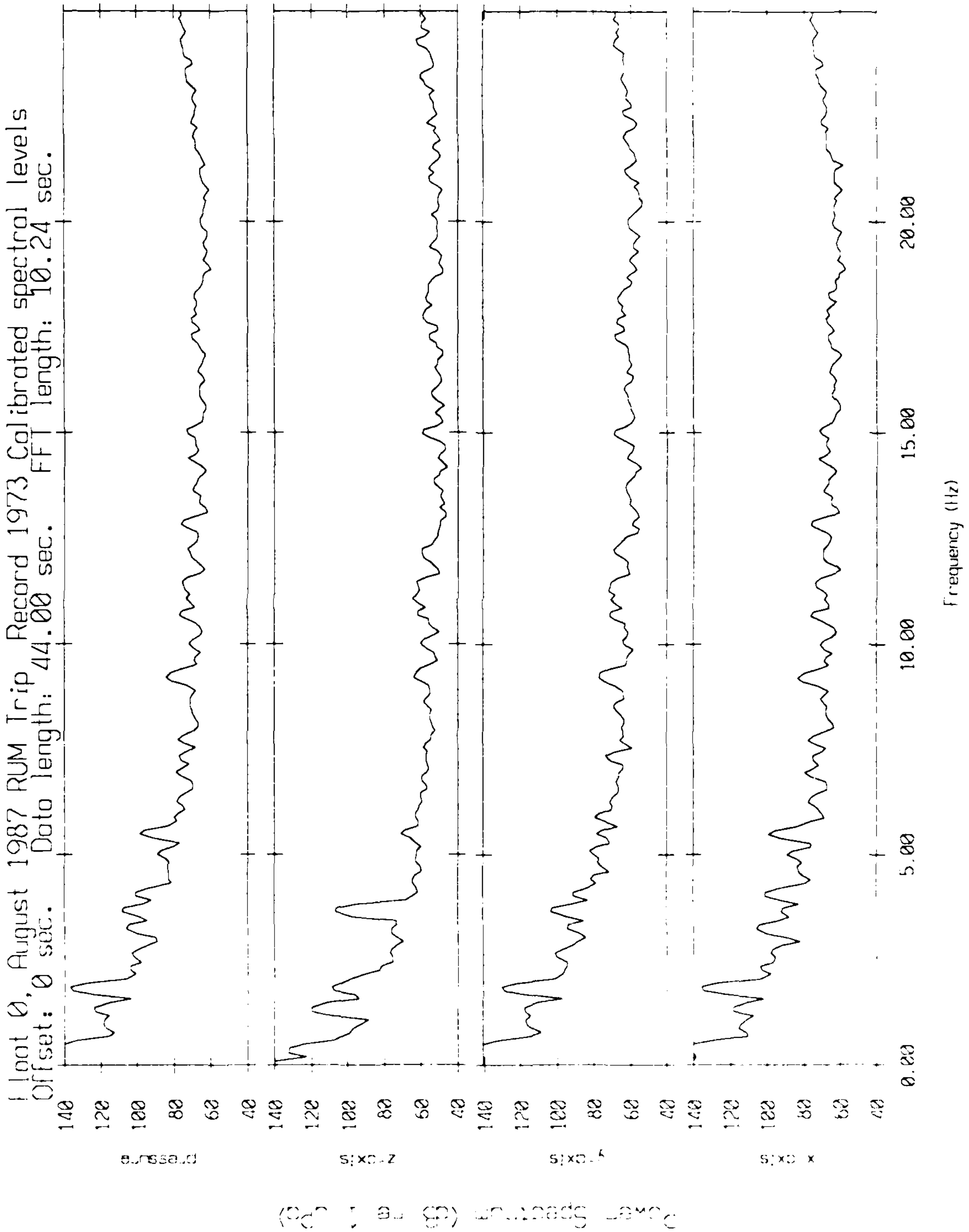
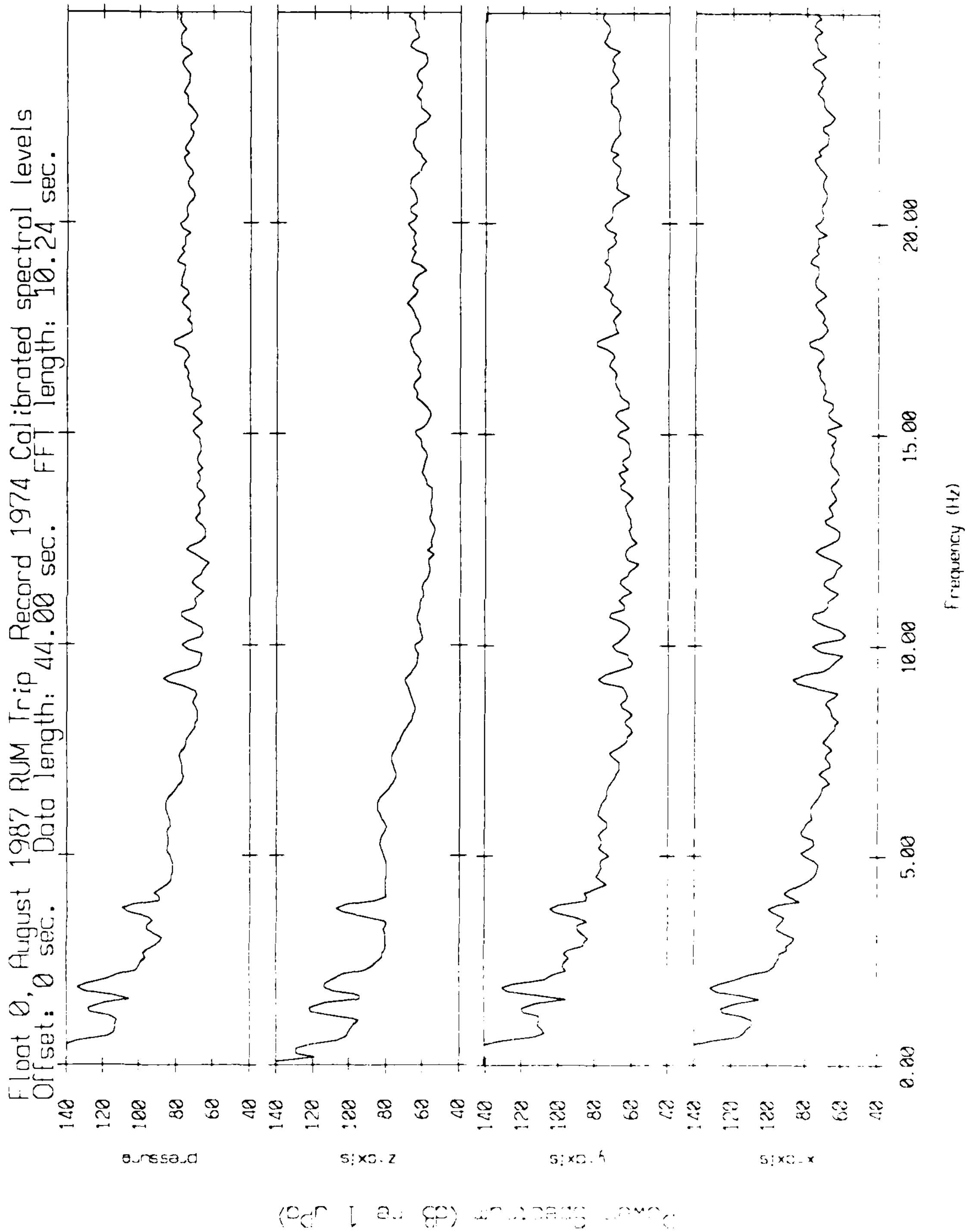
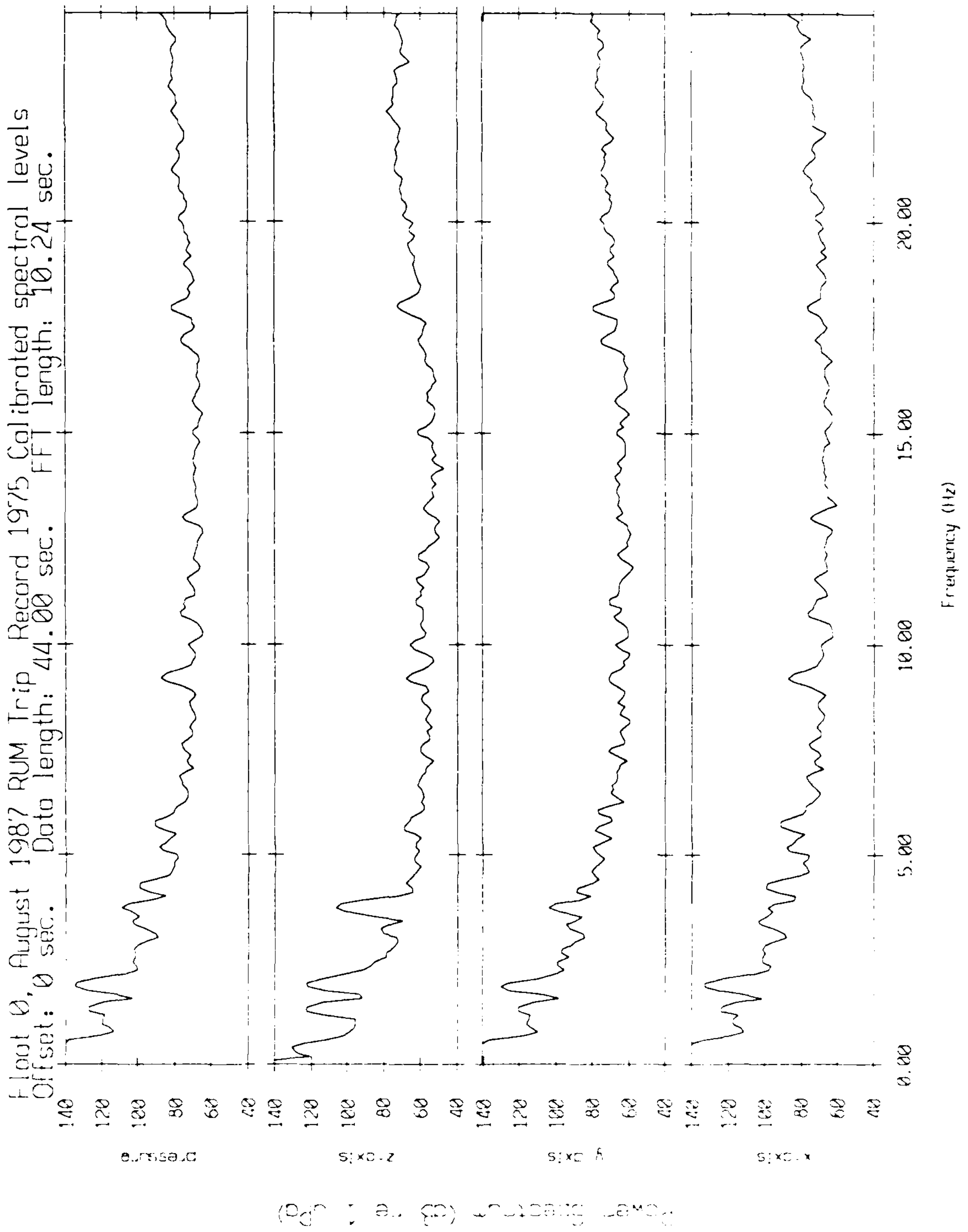

Float 0, August 1987 RUM Trip, Record 1973 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
Power Spectrum (dB re 1 uPa)
Frequency (Hz)

Figure VI.22



Float 0, August 1987 RUM Trip Record 1974 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
140
120
100
80
60
40
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)
Power Spectrum (dB re 1 µPa)

Figure VI 23



Float 0, August 1987 RUM Trip Record 1975 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z axis
y axis
x axis
140
120
100
80
60
40
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI.24

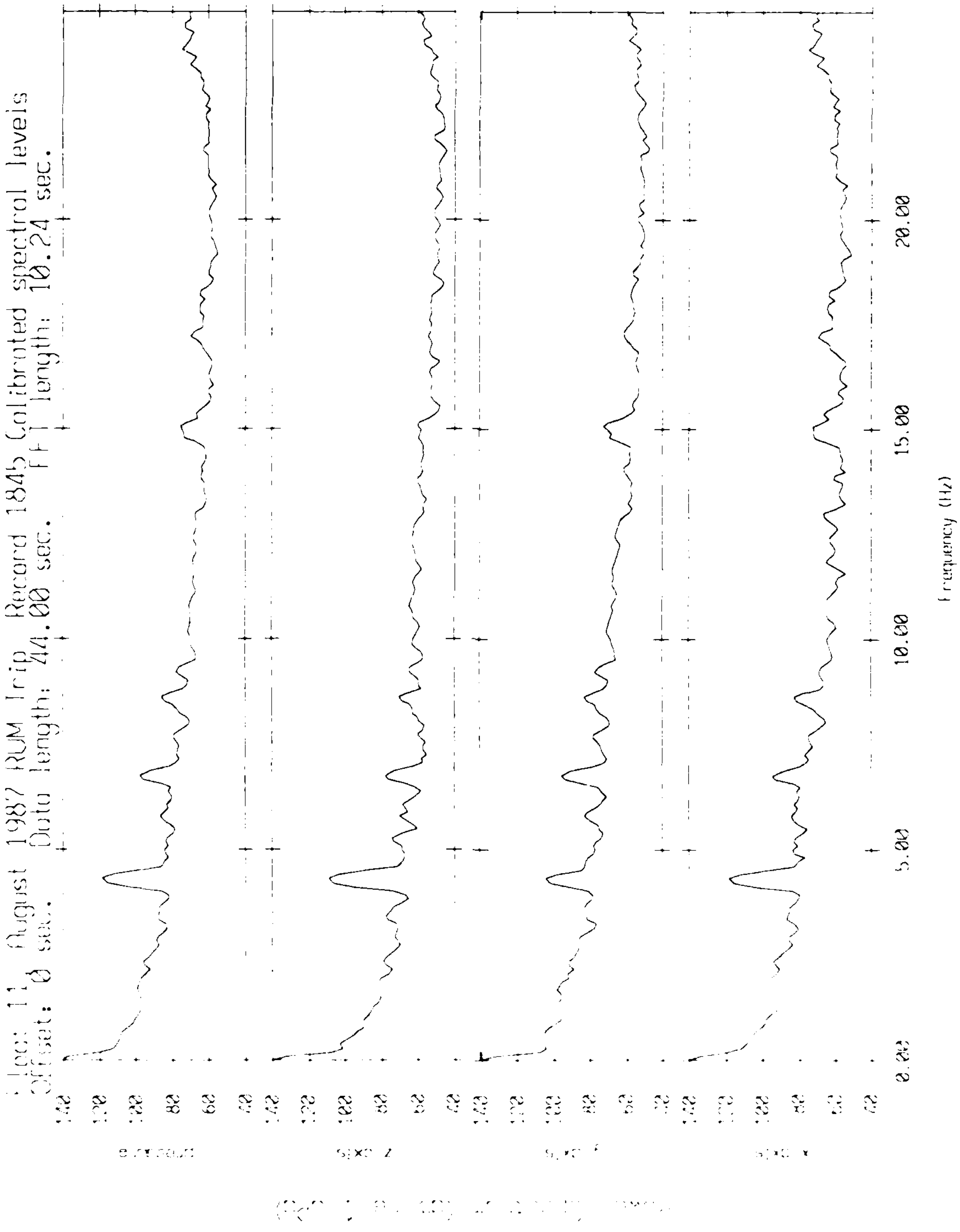

August 1987 RUM Trip, Record 1845 Calibrated spectral levels
Data length: 44.00 sec. FFT length: 10.24 sec.
Offset: 0 sec.
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI 25

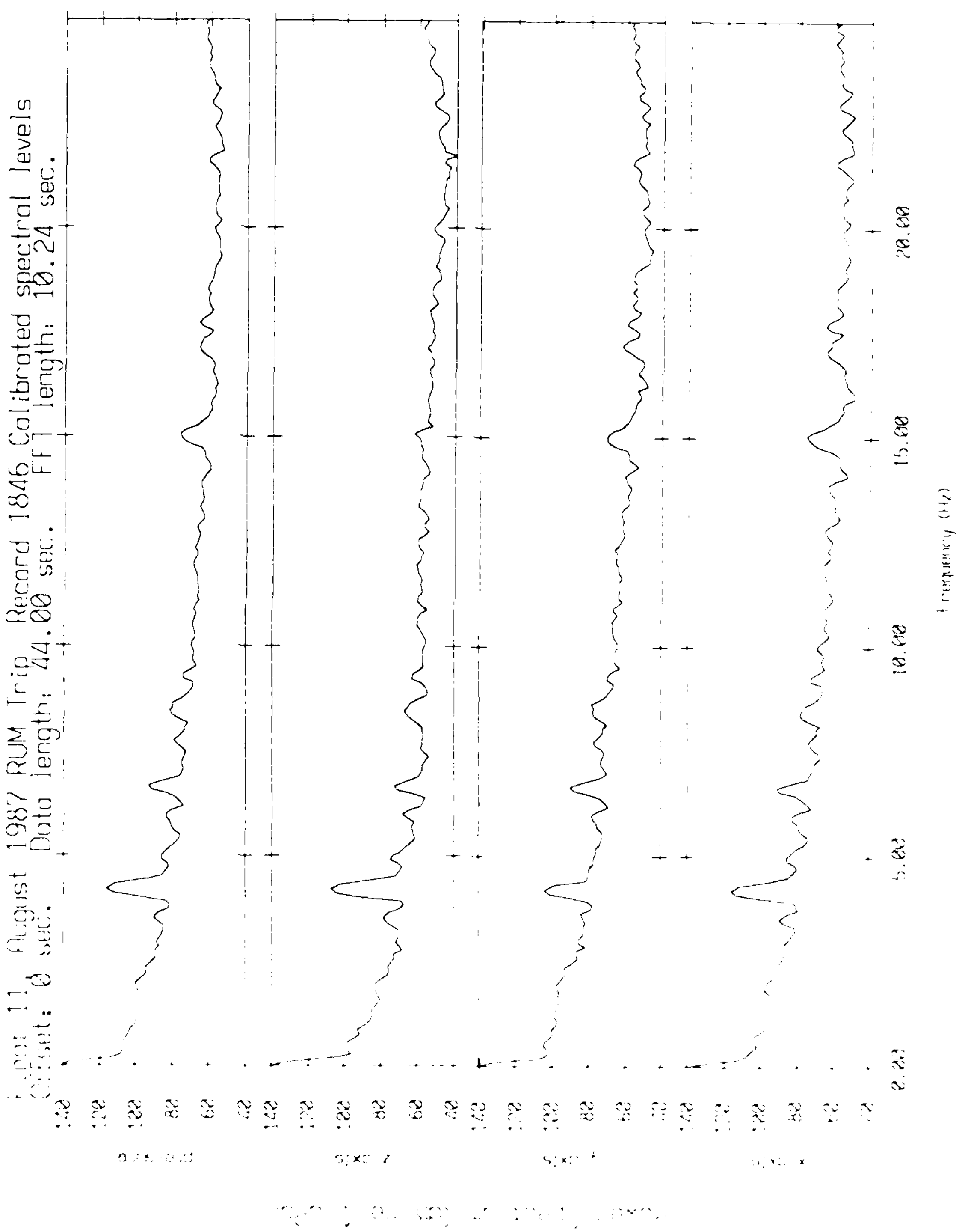

August 1987 RUM Trip Record 1846 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI-26

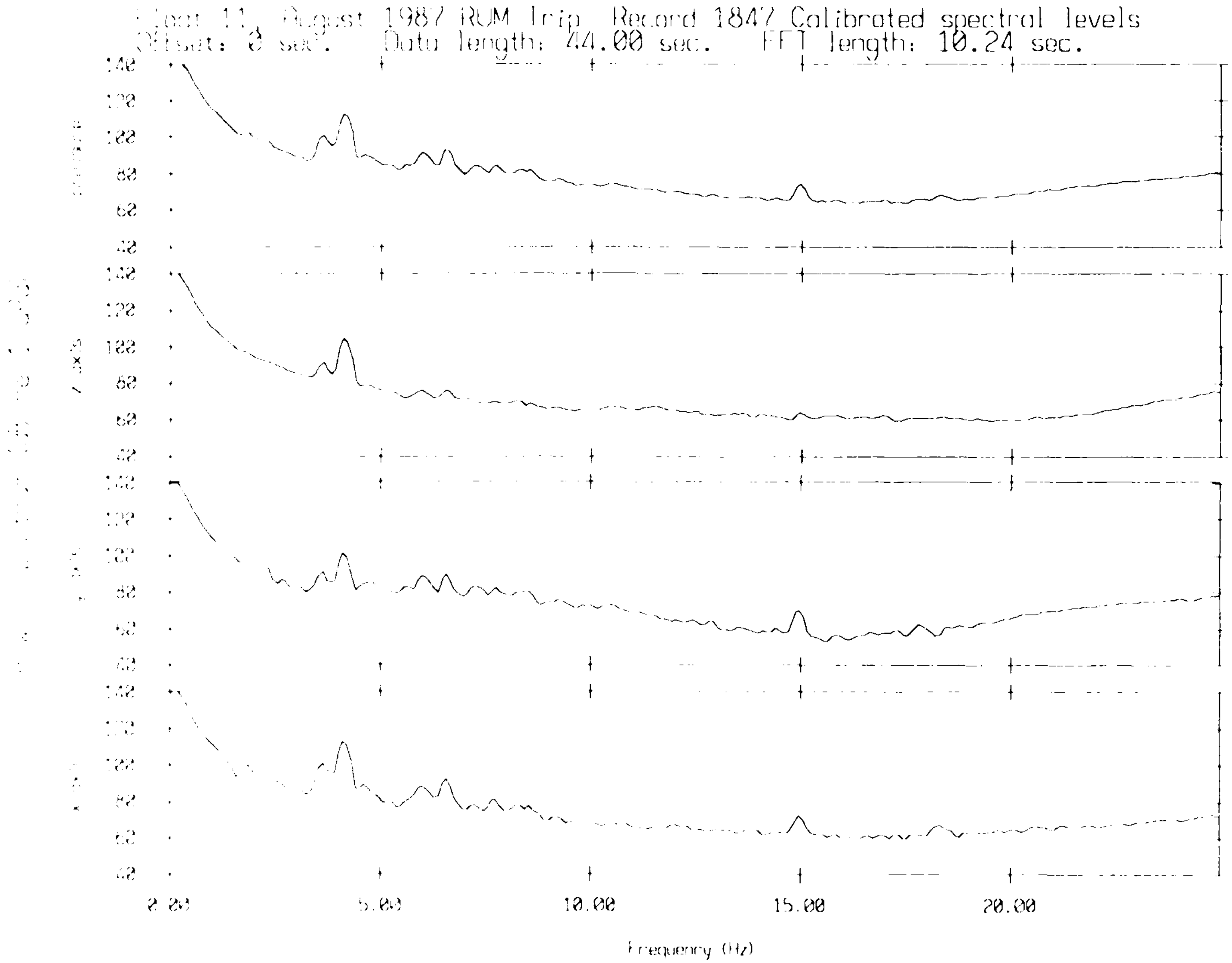
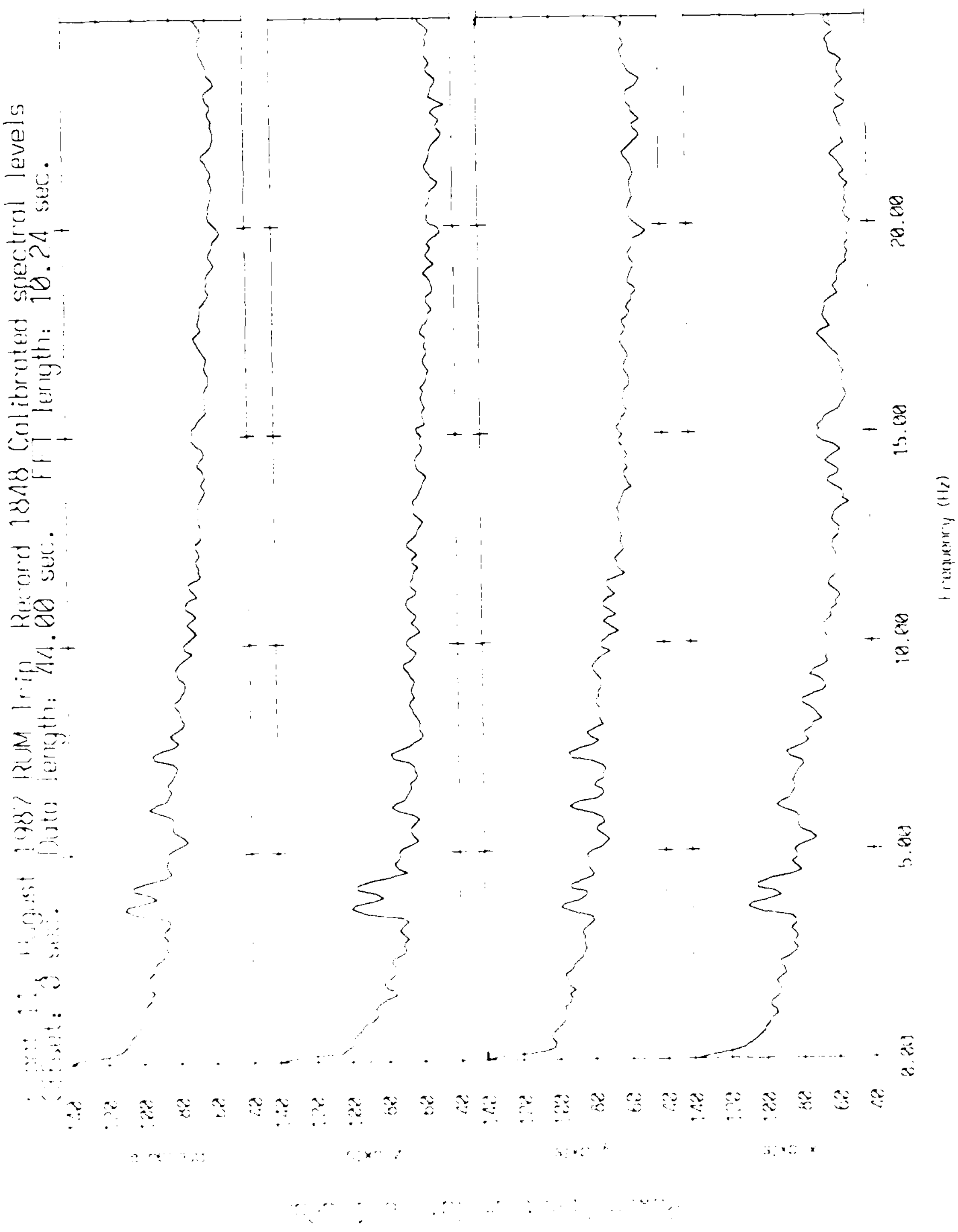

August 1987 RUM Trip Record 1847 Calibrated spectral levels
Data length: 44.00 sec. FFT length: 10.24 sec.
140
120
100
80
60
40
2.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI 27



1987 RUM Trip. Record 1848 Calibrated spectral levels
Data length: 44.00 sec. FFT length: 10.24 sec.
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI 28

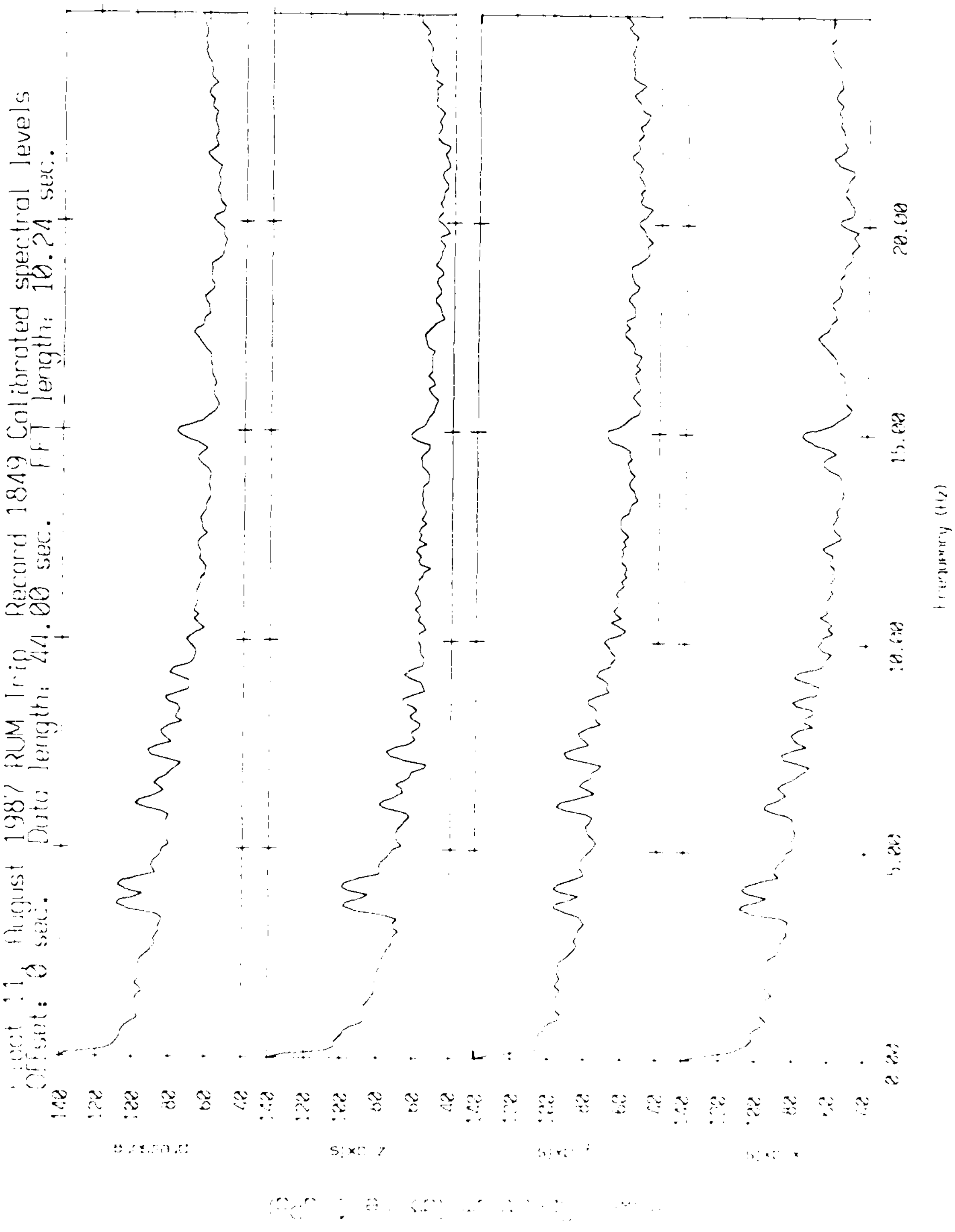
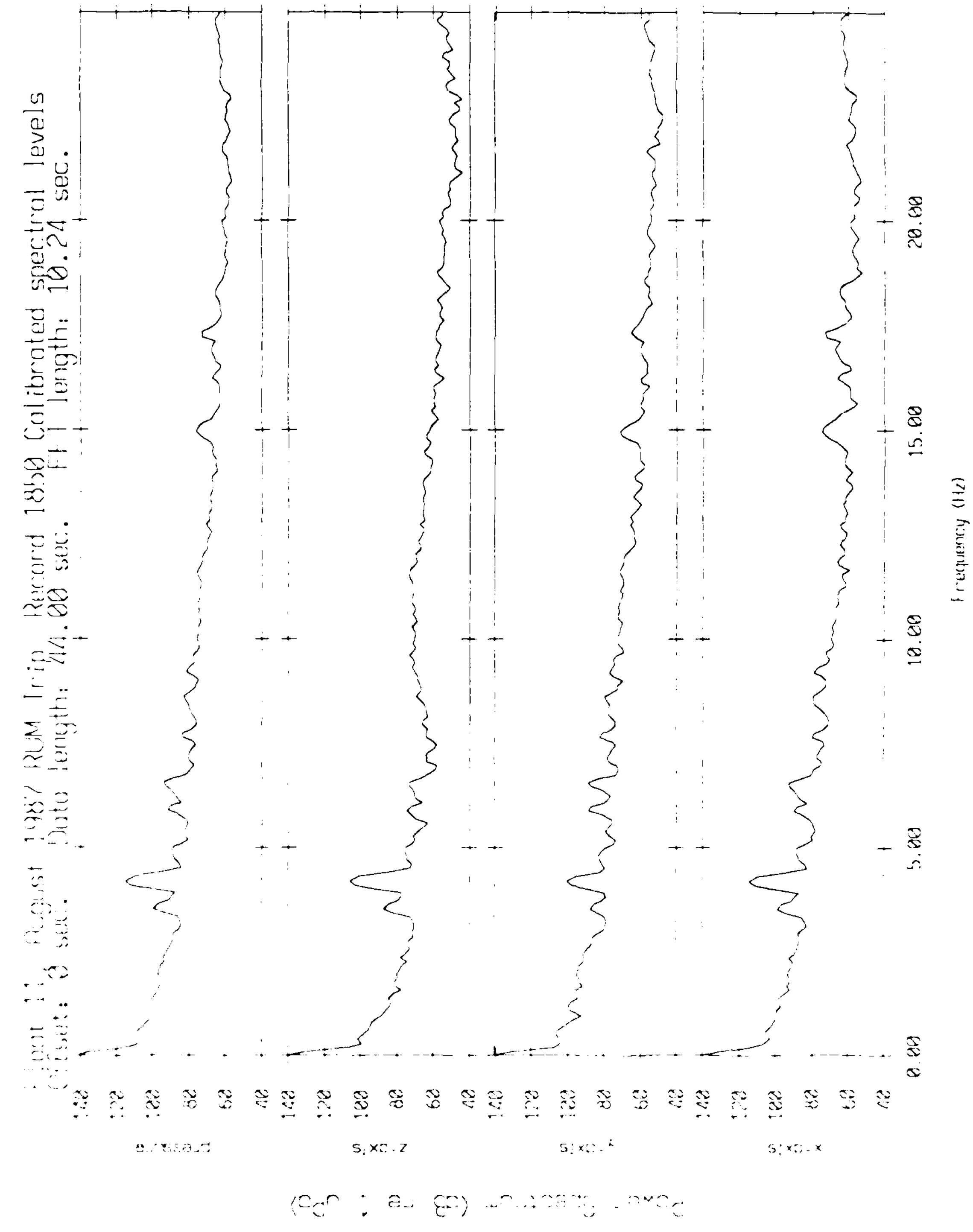

11 August 1987 RUM Trip. Record 1849 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
Frequency (Hz)

Figure VI.29



1987 RUM Trip Record 1850 Calibrated spectral levels
Data length: 44.00 sec. FFT length: 10.24 sec.
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI.30

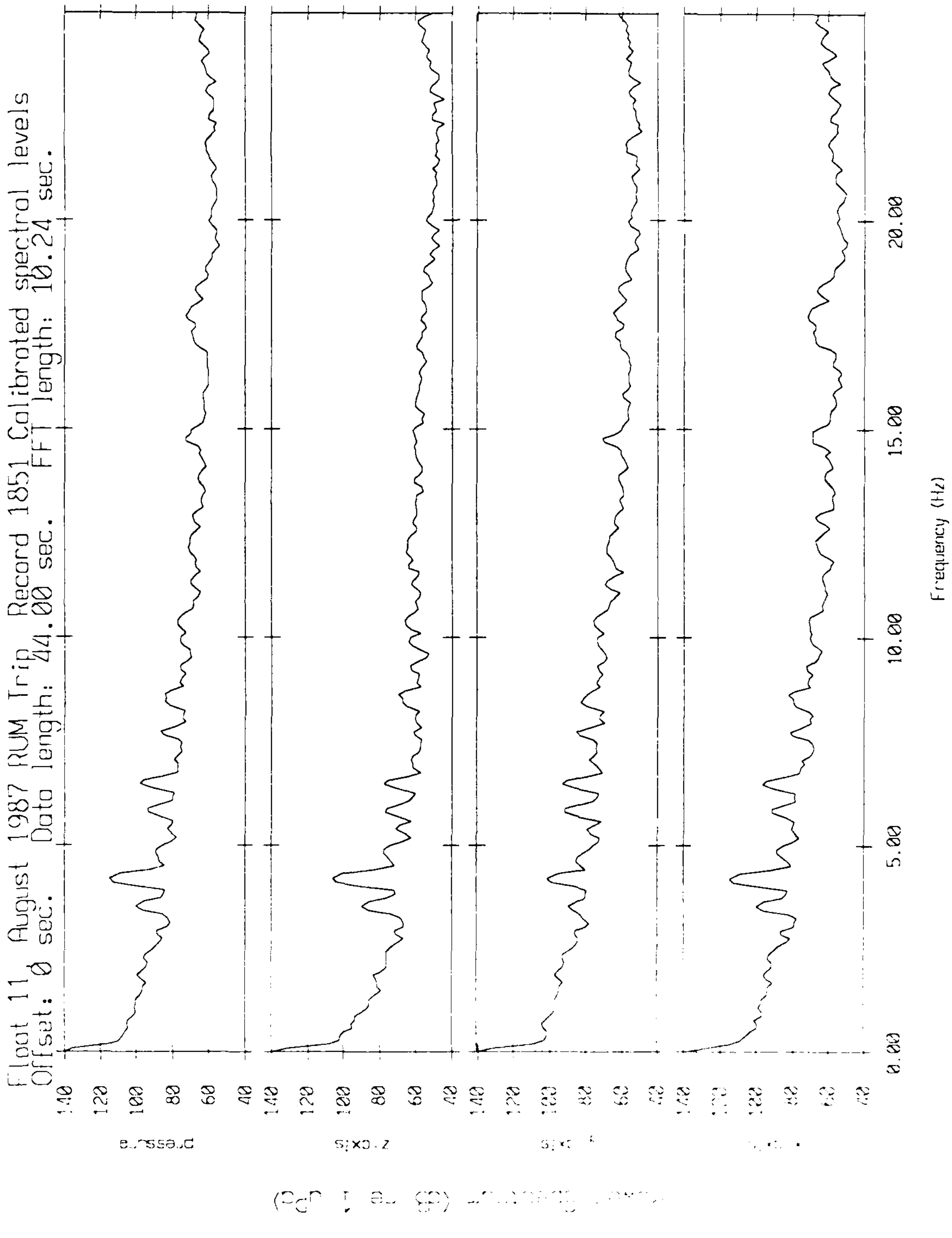

Float 11 August 1987 RUM Trip Record 1851 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
140
120
100
80
60
40
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)

Figure VI.31

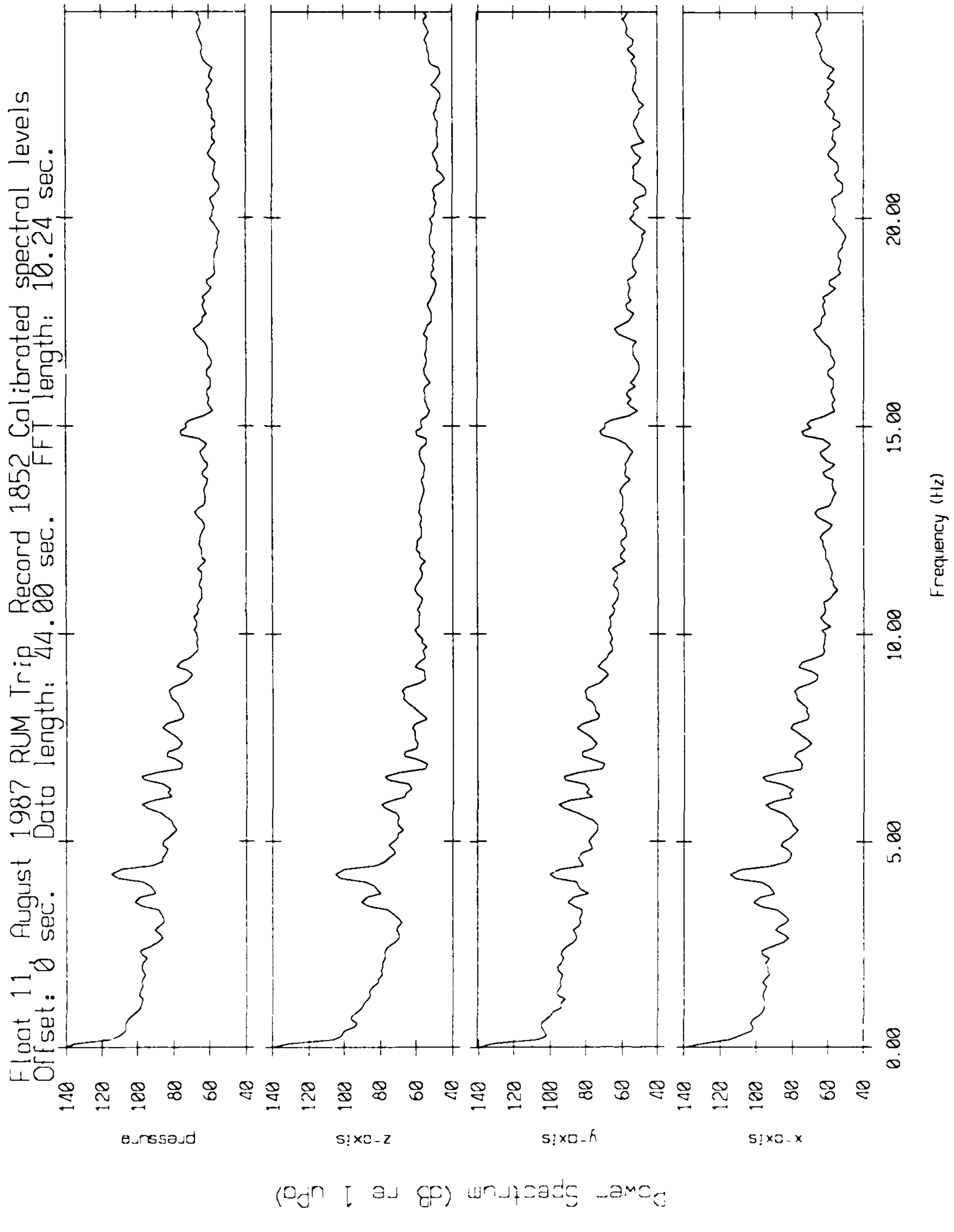

Float 11, August 1987 RUM Trip Record 1852 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
Power Spectrum (dB re 1 uPa)
Frequency (Hz)
0.00
5.00
10.00
15.00
20.00
140
120
100
80
60
40

Figure VI.32

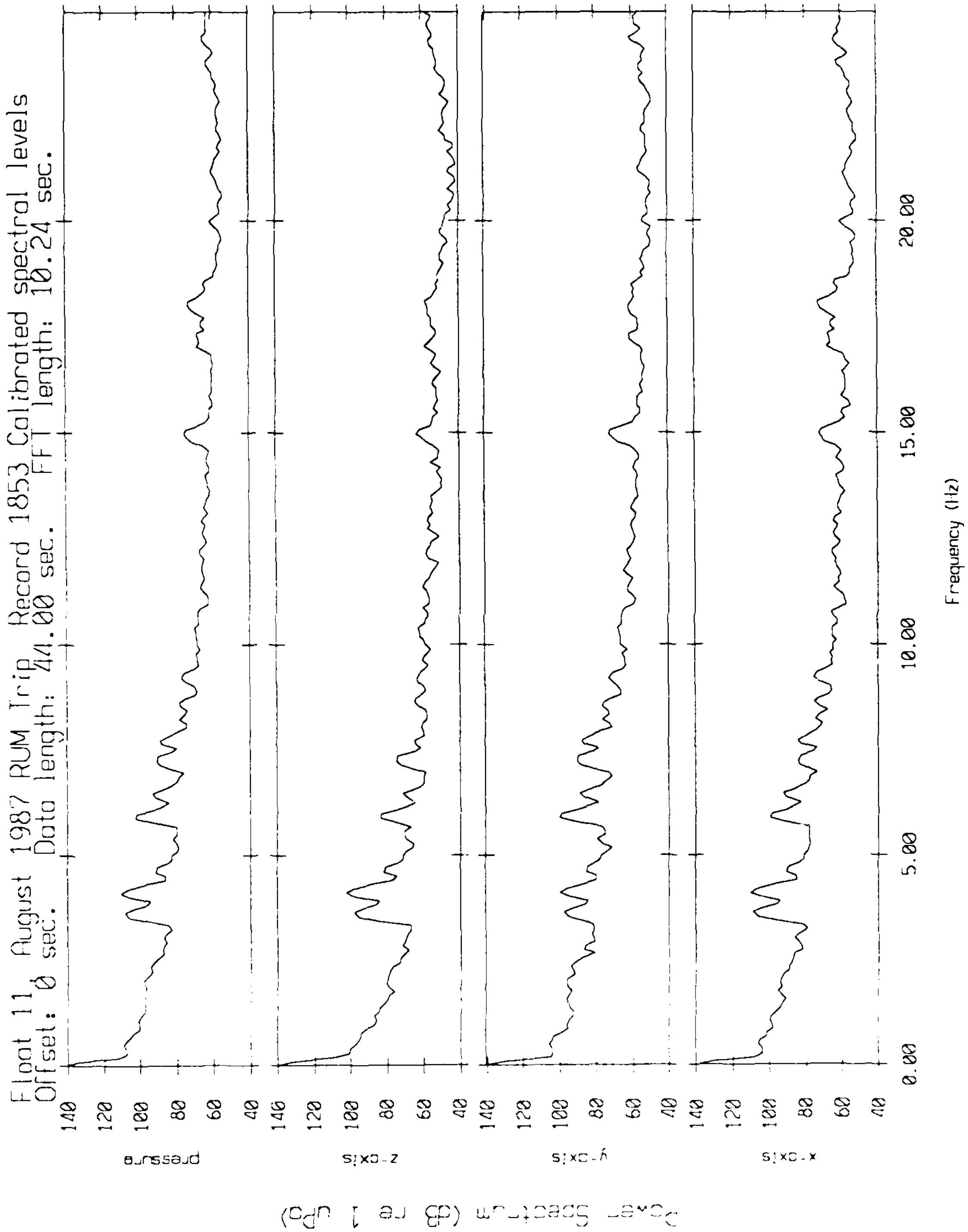

Float 11 August 1987 RUM Trip Record 1853 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
Power Spectrum (dB re 1 uPa)
Frequency (Hz)
0.00
5.00
10.00
15.00
20.00

Figure VI.33

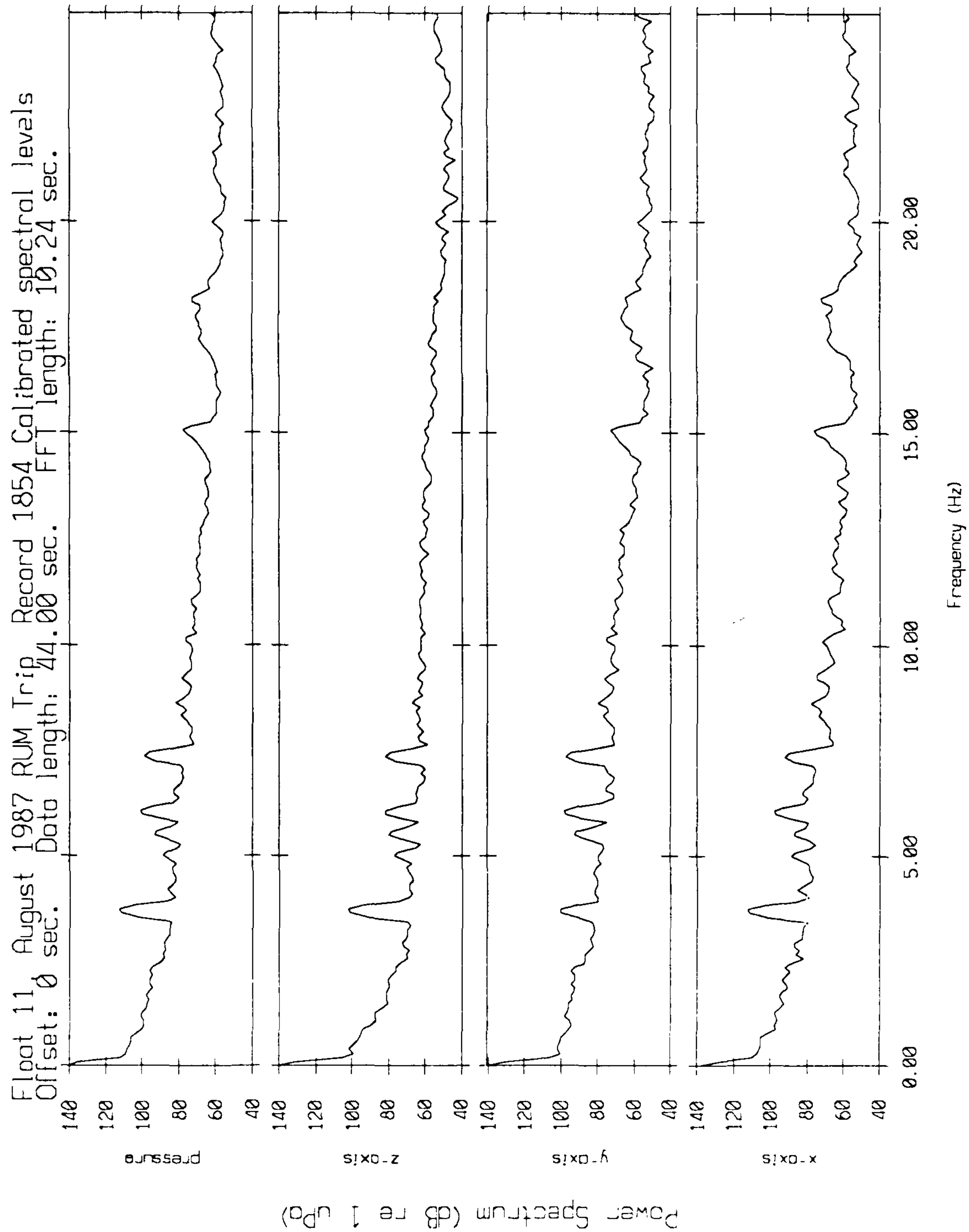
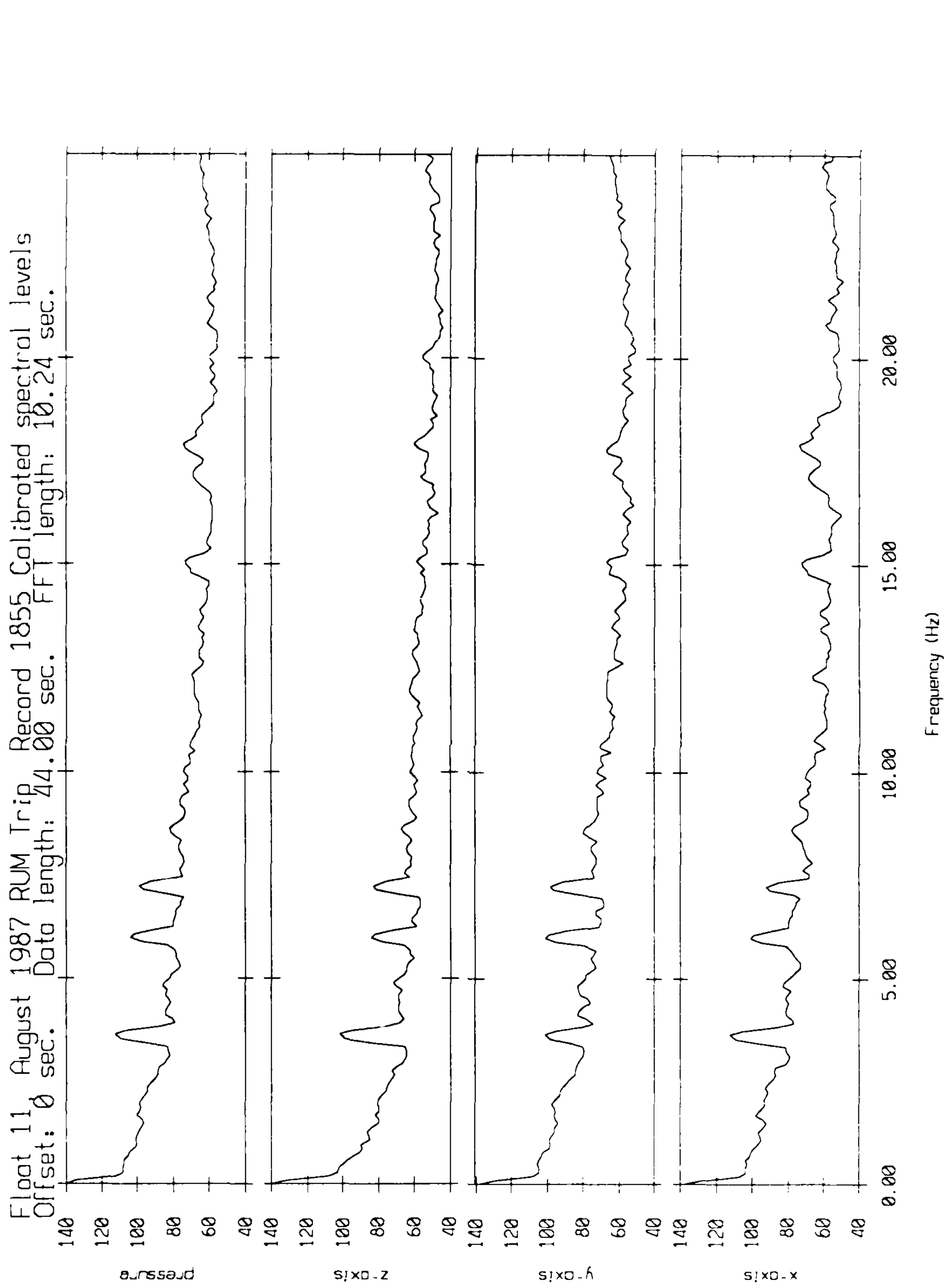
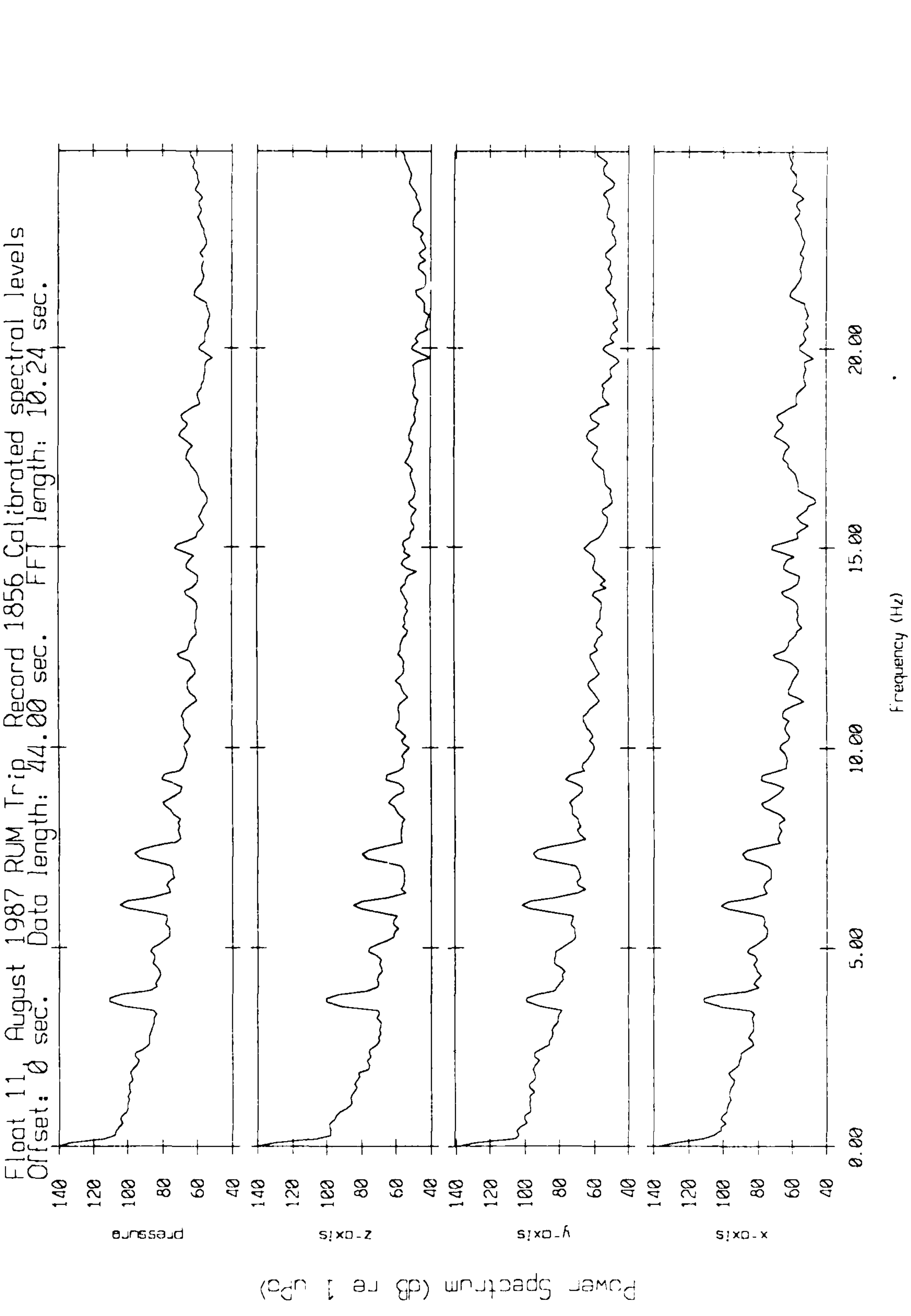

Float 11, August 1987 RUM Trip, Record 1854 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
Power Spectrum (dB re 1 uPa)
Frequency (Hz)
0.00
5.00
10.00
15.00
20.00
140
120
100
80
60
40

Figure VI.34



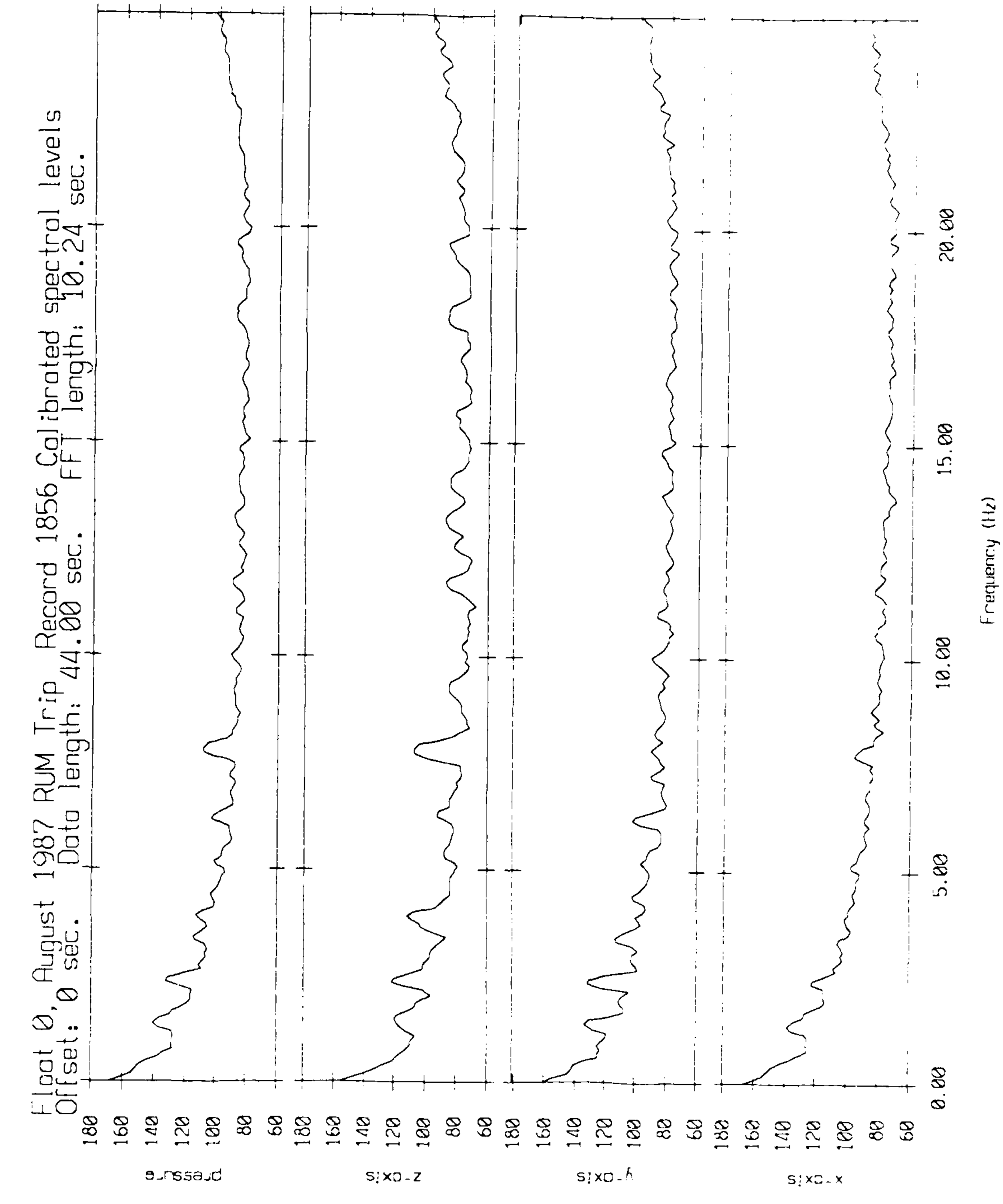
Float 11 August 1987 RUM Trip Record 1855 Calibrated spectral levels
Offset: Ø sec. Data length: 44.ØØ sec. FFT length: 1Ø.24 sec.
pressure
z-axis
y-axis
x-axis
Power Spectrum (dB re 1 uPa)
Frequency (Hz)
Ø.ØØ
5.ØØ
1Ø.ØØ
15.ØØ
2Ø.ØØ
14Ø
12Ø
1ØØ
8Ø
6Ø
4Ø

Figure VI.35



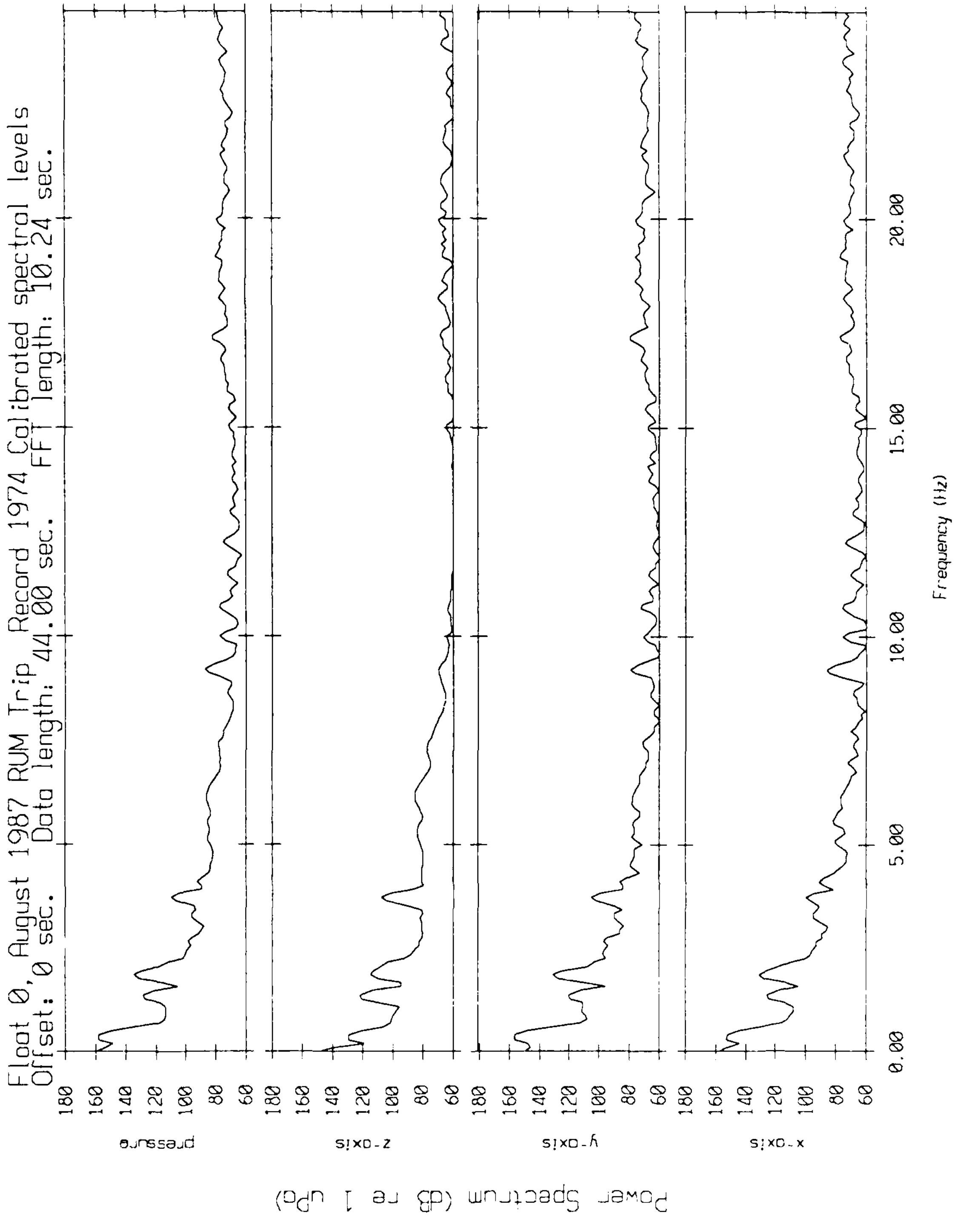
Float 11, August 1987 RUM Trip, Record 1856 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
140 120 100 80 60 40
0.00 5.00 10.00 15.00 20.00
Frequency (Hz)
Power Spectrum (dB re 1 uPa)

Figure VI.36



Float 0, August 1987 RUM Trip Record 1856 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
Power Spectrum (dB re 1 uPa)
180 160 140 120 100 80 60
0.00 5.00 10.00 15.00 20.00
Frequency (Hz)

Figure VI.37



Float 0, August 1987 RUM Trip, Record 1974 Calibrated spectral levels
Offset: 0 sec. Data length: 44.00 sec. FFT length: 10.24 sec.
pressure
z-axis
y-axis
x-axis
180
160
140
120
100
80
60
0.00
5.00
10.00
15.00
20.00
Frequency (Hz)
Power Spectrum (dB re 1 uPa)

Figure VI.38

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